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THE UNSUSPECTED FOREIGN BODY AS A FREQUENT CAUSE OF CHRONIC BRONCHITIS

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TO those whose memory covers a period of thirty years or more, the impression made upon our lay and early medical minds by the accident of a foreign body in the lung is quite too vivid to have been entirely modified by later-day developments.

The lasting impression is that the accident is of such frightful importance and its sequelæ so rapidly fatal as to be wholly incompatible with the words "unsuspected" and "chronic," and of such rare occurrence as to make the use of the word "frequent" quite unjustified.

The writer hopes in this communication to aid, in a small way at least, to correct these false impressions, and to present material fully adequate to justify the title chosen.

Acknowledgment must be made of the courtesy of Dr. Chevalier Jackson, from whose clinic all the material here presented has been taken, and whose permission and help have made this paper possible.

The inhalation of a foreign body is ordinarily accompanied by vivid sensations of suffocation and usually of terror. What then are the factors which make an unsuspected foreign body in the lung possible?

First and foremost must be placed infancy and childhood. The average mother sees several instances of inhaled foreign body lodging in the larynx or glottis. This familiar accident, with its short, sharp struggle and the instantaneous relief as the object is coughed out, is responsible for most of our impressions. What is less well recognized is the fact that relief is almost as rapid and complete if the body is released downward and passes into or beyond a main branch bronchus. It is most probable that in some of the cases here recorded the accident occurred in early childhood and was either not witnessed by the parent at all or quite discounted because of the immediate relief. It is significant, too, that if the accident has been witnessed, the child is reported to have swallowed, and not inhaled, the missing object.

In later life the habit of carrying small objects in the mouth and the quick inhalation of laughter or surprise is responsible for the accident, and the lack of sensation after the lodgment serves to allay the primary impression.

Intoxication is always to be reckoned with if such history is uncovered.

It is to be expected that many cases will develop from the vicissitudes of the present

war, since the habit of using the mouth as a handy receptacle will doubtless persist; and there also will be the occurrence of sudden painful injuries quite overwhelming the sensation of a concurrent choking.

Extreme physical fatigue such as is now occurring so frequently in the front line, followed by a sleep of exhaustion amounting to stupor, will again furnish all the other necessary factors, given a foreign body in the mouth.

The important things at the moment are, not how such an accident occurs, but that it does occur; that it is to be considered, and that it must be either eliminated as a cause or recognized as a cause in every case of chronic bronchitis or supposed tuberculosis of slowly advancing type.

Fortunately, we have to deal in chronic cases with objects inorganic in nature and therefore usually visible by roentgen rays. Inorganic, decomposable objects either are removed spontaneously or by the bronchoscope, or they rapidly produce abscess or other acute conditions. Exceptions to this rule will doubtless be found in small celluloid and aluminum articles and certain buttons, etc., made from organic, though not readily decomposable, materials. While invisible by roentgen rays, these will usually behave in the lung as do inorganic bodies and will produce a chronic reaction. The following case histories are cited as substantiating the claim indicated by the title.

CASE I.—M. N., female. Philadelphia. Age, 23 years.

HISTORY.—The patient came to the clinic of Dr. J. Solis Cohen at Jefferson Hospital in 1911. She gave a history of continual cough and foul yellowish expectoration for about a year and a half, during which time she had had an irregular temperature elevation and had lost weight. For seven years she had been subject to severe cough with expectoration during the winter, these symptoms disappearing in summer. The diagnosis of pulmonary tuberculosis had been made by a number of physicians.

On physical examination both apices were found free from disease; the only abnormal physical signs were slight impairment of resonance at the right base, with diminished voice and breath sounds. As these did not in Dr. Cohen's opinion sufficiently account for the symptoms, he referred the case to Dr. Manges for roentgen-ray examination. Stereoscopic plates showed a stricture of the right bronchus, with a metallic body resembling an upholsterer's tack, point upward, below the stricture and behind the bronchus. The patient remembered having "swallowed" a price-tag fastener seven years before; but, as she was told that it would pass harmlessly, she had forgotten the occurrence. She had had no symptoms whatever until the following winter.

CASE II.—H. E., male. California. Age, 20 years.

HISTORY.—Nine years ago, while eating beef and vegetable soup hurriedly, he felt a bone in his throat. He choked and coughed and expectorated what he thought was bone but his parents did not examine the sputum to see if bone was present. He spat up streaks of blood. Then constant cough supervened. He consulted many physicians, all of whom said the bone would have disappeared long ago. He was sent to a sanitarium, where he was given seven months' rest crue, and autogenous

FIG. 1.

vaccine. The sputum examination was negative. The cause of the abscess was not known. Dr. Zimmerman of Sacramento made stereoscopic plates showing what was thought to be a bone. Bronchoscopy was done in San Francisco seven years ago with negative result. (Fig. 1.)

Roentgen-ray examinations by Dr. Manges revealed a small foreign body shadow with considerable accompanying pathology in the region of the right descending branch bronchus. The foreign body was removed by oral bronchoscopy April 19, 1917, by Dr. Jackson. It proved to be a piece of bone.

CASE III.—J. W. B., male. Canada. Age, 58 years.

HISTORY.—For six months the patient had typical signs and symptoms of chronic bronchitis with acute exacerbation. There was no history of onset, merely a cough which persisted. Sibilant and sonorous râles in the left lung cleared up after a couple of months, but a small area in the right lung in the region of the lower portion of the upper lobe and upper portion of the middle lobe did not clear up, and nothing seemed to help it. Fluoroscope examination by the attending physician disclosed at the hilus of the right lung a dark area, which he attributed to calcified glands.

After several months, the condition not improving, the patient was referred to Dr. W. B. Bowman, of Los Angeles, who reported a foreign body in one of the large bronchial branches on the right side near the root of the right lung, with marked peribronchial thickening in the lower lobe of the right lung, some peribronchial thickening in the left side, and many fibrous changes, probably of non-tuberculous origin.

Roentgen ray examination by Dr. Manges (Fig. 2) led him to believe that there was a tubular metallic foreign body present. The foreign body was removed by oral bronchoscopy April 21, 1917, by Dr. Jackson. It proved to be the tip of an atomizer which the patient remembered using for a throat condition. The tip came off during use, and the exact nature of the foreign body was not suspected until after removal.

CASE IV.—M. T. McM., female. Tennessee. Age, 3 years.

PRESENT ILLNESS.—Nov. 5, 1916, the patient fell while holding a safety pin in her mouth. She became hoarse and developed a severe whoop-like cough. She was treated for laryngeal diphtheria. The severe cough with paroxysms was sometimes

FIG. 2.

attended with vomiting and expectoration of purulent material, which continued to the present time. June 8, 1917, she coughed up the blade portion of a small safety pin. Fluoroscopy showed the remainder of the pin in the left bronchus.

ROENTGEN RAY REPORT. — June 19, 1918. (Fig. 3.)

There is a safety pin in the left bronchus; half of the pin carrying the shield is broken off just at the coil; the coil and pin are missing. As it lies in the bronchus this broken end is apparently in the bifurcation of the trachea, while the shield is down the left bronchus, the shield being rotated backward.

The foreign body was removed by oral bronchoscopy, June 19, 1917, by Dr. Jackson.

CASE V.—M. E. T., female. Washington, D. C. Age, 15 years.

PRESENT ILLNESS.—Sept. 2, 1916, while holding pins in the mouth in the act of undressing, the patient was frightened and aspirated some of the pins. She had a paroyxsm of coughing attended by some hemoptysis and substernal pain on breathing and coughing. One week later she was taken to a hospital in Washington, D. C., where by the roentgen rays three small pins (straight, ordinary) were found in the intestines. She was studied four months and then discharged with the statement that the pins had been passed. During this time the patient had complained of substernal pain on deep breathing and coughing; coughing (worse on lying down and after eating) was attended by purulent and occasionally blood-streaked sputum. At times she spat up about one dram of bright red blood. She vomited after each meal and sometimes during sleep. She lost 18 pounds in weight and had occasional night sweats. These symptoms led to a chest examination. The roentgen ray examination showed a safety pin in the left lung. Attempts at removal were made under ether with failure to recover the pin, and the case was referred to Dr. Jackson.

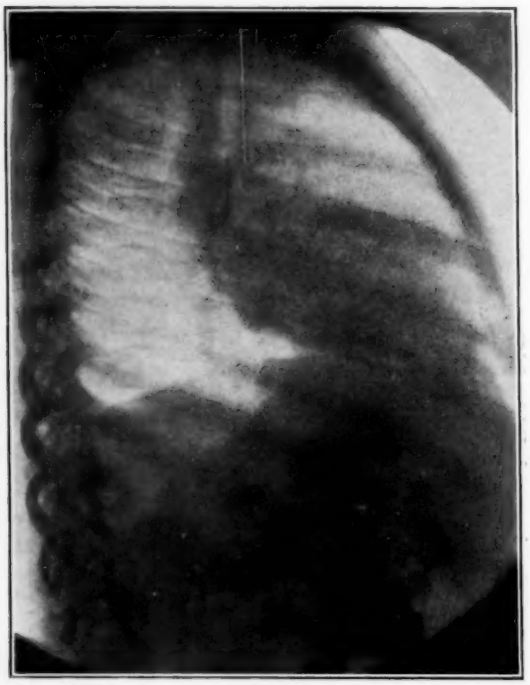

FIG. 3.

The examination at Jefferson Hospital by Dr. F. F. Borzrel showed the pin lodged in the left bronchus. It was removed by oral bronchoscopy June 23, 1917, by Dr. Jackson.

CASE VI.—M. W., female. Pennsylvania. Age, 12 years.

PRESENT ILLNESS.—In May, 1917, the patient was holding a shoe button in her mouth as she ran upstairs. Her father came out of a nearby room and as the patient gasped from fright she aspirated the shoe button. A couple of days later she began to cough, and in June developed pneumonia. Since then, the cough has increased. During this illness the patient suffered from pain in the left arm, upon motion, which started under the left scapula and radiated down the arm to the elbow. The pain was present only upon motion and disappeared when she had recovered. She had an attack of la grippe in August, 1917, and the pain

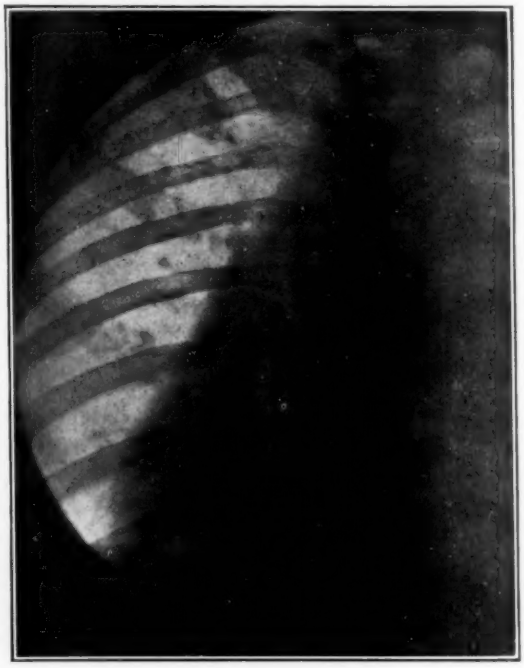

FIG. 4.

in her left arm reappeared. Upon recovery from la grippe the pain disappeared. The patient has gained weight in the last few months.

My Roentgen Ray Report.—Dec. 17, 1917. (Fig. 4.)

I find a shadow in the left chest at the level of the upper border of the seventh rib, posteriorly, and at about the level of the upper border of the third rib, anteriorly. This shadow presumably represents the wire eye of the shoe-button which the child is supposed to have inhaled. It is impossible to visualize the button itself.

The foreign body was removed by oral bronchoscopy, December 18, 1917, by Dr. Jackson.

Case VII.—D. W., male. South Carolina. Age, eight years.

Present Illness.—In February, 1916, the child put a tack in his mouth and took a deep inspiration, aspirating the tack. Paroxysms of coughing immediately followed the accident, but these soon subsided. Three days later pneumonia developed and lasted ten days. The doctor who treated the patient for pneumonia was told of the "swallowing" of the tack, but ignored it. The cough continued and the patient lost weight and failed to develop physically following his illness. In March, 1917, the patient was sick four days and was treated by Dr. S., South Carolina. Dr. S. was told of the tack and in April, 1918, because of the child's continued coughing and failure of development, referred the patient to Dr. A. R. Fike of Spartansburg, who made a radiograph which showed a tack in the right bronchus. Two unsuccessful attempts were made at bronchoscopic removal during the month of April, 1918. Some slight reaction followed the bronchoscopic attempts.

My Roentgen Ray Report.—May 16, 1918. (Fig. 5.)

There is considerable pathology in the right lung, which to some extent, at least, involves the parenchyma of the lung. The larger bronchial branches can be seen penetrating the lung. The nail is now lying in a branch of the lower left bronchus, nearly midway from before backwards. There is considerable pathology also on this side, but very much less than on the right. The head of the nail is directed downward.

The tack was removed by peroral endoscopy, May 17, 1918, by Dr. Jackson.

Case VIII.—R. D. M., male. Canada. Age, eight years.

Present Illness.—When two and a half years old while seated at the dinner table the child suddenly spat up a mouthful of blood. An attack of broncho-pneumonia followed, lasting one week. A severe cough

Fig. 5.

productive of a purulent expectoration followed the broncho-pneumonia, and at irregular periods the child spat blood in amounts varying from a mouthful to blood-streaked sputum. For about two years these symptoms continued in great severity, finally decreasing in severity and the hemoptysis ceasing. The cough, however, persisted and the purulent expectoration continued at intervals. There has never been a septic temperature, nor have there been night sweats. The child failed to grow strong and was examined repeatedly for tuberculosis. The sputum reports have always been negative. A roentgen-ray examination of the chest was made in

June, 1917, when a foreign body was discovered in the lower right lobe. There were two bronchoscopies under ether anesthesia at an interval of one week. Both failed and the patient was sent home.

EXTRACT FROM MY REPORT.—June 3, 1918. (Fig. 6.)

There is a foreign body in the base of the right lung. By fluoroscopy the diaphragm shadow may be seen to rise so as to cover completely the foreign body shadow, and fall so as to clear it entirely.

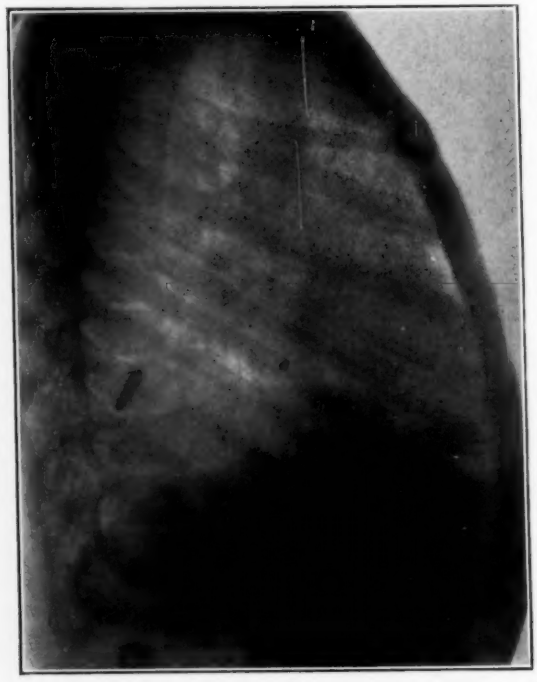

FIG. 6.

The foreign body is slightly less than three-quarters of an inch in length and about one-quarter of an inch in diameter at its upper larger and blunt extremity. From this it tapers to a rounded point. I have a suspicion that it is the steel tip which fits into a tubular umbrella stem. There is strikingly little pathology to be seen—just a slight increase in density around the foreign body.

The foreign body was removed by oral bronchoscopy, under fluoroscopic control, June 4, 1918, by Dr. Jackson.

CASE IX.—M. J. C., female. Pennsylvania. Age, 48 years.

PRESENT ILLNESS.—In the middle of February, 1918, while trying to hang a curtain she aspirated accidentally a large double pointed carpet staple. Immediately following the accident the patient strangled and coughed for 5 or 10 minutes, and spat small amounts of blood. The symptoms subsided but the patient had the sensation of a foreign body in about the middle of the left chest. Later symptoms consisted in cough and copious yellowish purulent expectoration, never blood-streaked. At the time of the accident the doctor who was consulted insisted that the patient had swallowed the staple and advised eating dry foods. (He gave no cathartics.) The general health seemed but little affected, with the exception of early fatigue and interference of sleep by the incessant coughing. About one month ago she began complaining of a dull, aching pain in the left fifth interspace about two inches from the midline. This pain was aggravated by coughing, and lately has been referred to the left back. The amount of expectoration has grown less, and on two occasions the sputum contained black, crummy masses. The patient complains of an inky taste in the mouth after coughing. The doctor had urged a roentgen ray examination of the chest, but the patient delayed until the pain in the chest became annoying.

Roentgen ray examination at Geisinger Hospital, Danville, Pa., July 17, 1918, revealed the staple.

MY ROENTGEN RAY REPORT.—July 20, 1918. (Fig. 7.)

Carpet staple in the left main bronchus. Apparent width of spread between points is approximately correct. Length of the two arms is slightly foreshortened. Resulting pathology not apparent.

The foreign body was removed by oral bronchoscopy, July 22, 1918, by Dr. Jackson.

CASE X.—W. J. A., male. New Mexico. Age, 22 months.

PRESENT ILLNESS.—On May 17, 1918, while the patient was playing in the yard his mother heard him choking and strangling. She thought he had swallowed something and held him upside down and

FIG. 7.

provoked vomiting by passing her finger down his throat. He coughed for about an hour. He complained of pain in the region of the larynx and the respiration increased in rate and became labored and wheezing; the nostrils became pinched and great cyanosis developed. Doctors were consulted and advised immediate hospital treatment. The patient was taken to a New Mexico hospital, where the doctor examined the patient and passed a forceps, the ends of which were wound with cotton, down the throat. This procedure seemed to relieve the pain in the throat, but the dyspnea continued. The doctor did not think a foreign body was present. A roentgen ray examination was proposed, but during the child's four days' stay in the hospital this was not done. The mother became impatient and took him to St. Louis where Dr. Belton made a roentgenograph and reported the presence of a tack in the right bronchus at the level of the sixth rib. On the arrival in St. Louis the dyspnea gradually subsided. A bronchoscopy was done under ether lasting one hour, but the tack was not removed. Considerable hoarseness followed the bronchoscopy, but no dyspnea developed. The patient was discharged from hospital two days after the bronchoscopy. He has lost some weight since the accident and now complains of an occasional cough, and restlessness, but has gradually improved since the bronchoscopy.

MY REPORT.—August 12, 1918. (Fig. 8.)

There is a carpet tack, head downward, in the vicinity of the lower lobe bronchus. The head is too low down to be contained in a bronchus of normal diameter, but the location and direction correspond very accurately to the normal position. It is situated opposite the sixth rib, approximately two inches below the arch of the aorta.

The foreign body was removed by oral

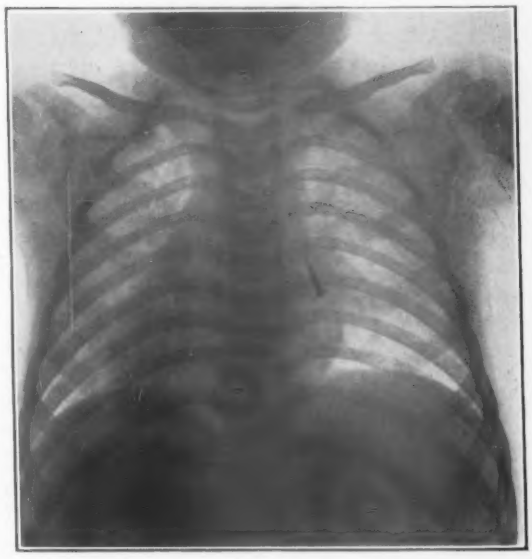

FIG. 8.

bronchoscopy, August 12, 1918, by Dr. Jackson.

CASE XI.—V. M. S., female. Florida. Age, 38 years.

PRESENT ILLNESS.—Eight years ago the patient began to be troubled with a cough, and once a week would expectorate a mass of material the size of a pea, of a cheesy consistency, greenish-brown in color and of foul odor. She was thoroughly examined in Kansas City but no evidence of tuberculosis was found. The sputum and all secretions were examined. She led an out-of-door life for the next two years. It was then necessary to have a perineorrhaphy performed and she went to her home in Binghamton, N. Y., where Dr. —— in the course of his examination had a roentgen ray made of the chest, and found an open safety pin present in the right bronchial region. Dr. —— advised "leaving the pin alone as long as it left her alone." The cough increased in severity and frequency and masses similar to those first described were expectorated more frequently. In the latter part of May, 1918, she had a pulmonary hemorrhage followed by a second a week later. Hemorrhages recurred once and twice daily until the time of admission. The amount varied from six to sixteen ounces. Her physician considered the case tuberculous in spite of being told of the presence of the safety pin in the lung, and he wired the husband that the case was hopeless. Mr. S. immediately left for Florida and brought his wife to Philadelphia for treatment by Dr. Jackson. She arrived in a stuporous condition, coughing up blood-streaked sputum. Her breath smelled of acetone. The patient and her family had no knowledge of how or when the foreign body was aspirated.

ROENTGEN RAY REPORT. — July 11, 1918. (Fig. 9.)

There is an open safety pin in the right thorax which I believe is engaged in the inferior branch of the right bronchus. There is a great deal of pathology in both lungs, but particularly in the right lower lobe, where there is a thickening which amounts almost to consolidation, although the bronchial tree markings can be plainly seen through the density. The pathology on both sides diminishes markedly toward the apex.

The patient was admitted to the Hospital July 11, 1918.

She died July 15, 1918. No bronchoscopy was done.

Extended description of technique has no place in this paper, but caution may be urged as to two points:

In the determination of minute bodies, small pins for instance, motion must be eliminated completely or there may result a plate of rather pleasing quality but quite worthless for the purpose, because the foreign body has not remained long enough at any one place to cast a visible shadow. This is particularly true if the body is lodged toward the lung base. The respiration must be lengthened or the exposure shortened to the point where perfect lung exposure for the entire exposure is assured. The patient, not the tube, is to have first consideration. In children too young to cooperate by holding the breath, I use a tube that will pass about 150 ma. at a five inch spark gap and make the exposure at the peak of respiration without an intensifying screen.

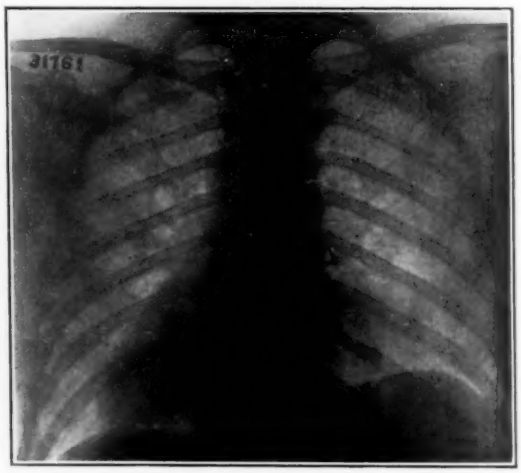

FIG. 9.

The second caution is to repeat what has been said often and well in previous meetings by Dr. Johnston. Objects in the lung which are quite invisible by roentgen rays may still frequently be localized by a visible surrounding pathological condition. Don't say you can't show them until you have tried.

CONCLUSIONS

For a variety of reasons unsuspected foreign bodies in the lung are of frequent occurrence, much more frequent than previous experience has indicated. The usual diagnosis is chronic bronchitis; less frequently, it is slowly advancing tuberculosis. The average general practitioner today is far too apt to discount the probability of the presence of a foreign body in the lung.

It is not only the privilege of the roentgenologist, but his manifest duty, to urge upon his medical conferees, in season and out, when opportunity offers and when opportunity has to be created, that all cases of obscure lung pathology should be examined by roentgen rays, if for no other reason than to determine the presence or absence of foreign bodies.

ROENTGEN RAY AND RADIUM IN THE TREATMENT OF BASAL CELL EPITHELIOMA*

A STATISTICAL STUDY

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THE first basal cell epithelioma to be treated with the roentgen ray was demonstrated before the Swedish Medical Society on Dec. 19, 1899, by Stenbeck[1] of Stockholm. At the same meeting Sjögren[2] showed a similar case. In the former instance, however, the epithelioma had disappeared, while in the latter the demonstration occurred before a complete cure had been effected. These reports were immediately followed by others and very soon the literature was swamped with articles on this subject. The earliest reports in Europe were from the pens of Sederholm,[3] Scholtz,[4] Taylor,[5] Ferguson[6] and Sequeira.[7] In the United States the earliest workers were Johnston and Merrill,[8] Pusey,[9] Williams,[10] Beck,[11] Rinehard,[12] Morton,[13] Hopkins,[14] Allen[15] and Duncan.[16]

In the past twelve years a voluminous literature dealing with roentgenotherapy in basal cell epithelioma has been developed. But before reviewing and commenting on the more important articles the author desires to tabulate and discuss the results obtained in 258 unselected cases of basal cell epithelioma which were treated between the years 1910 and 1916, inclusive. The cases were treated in accordance with the intensive technic and the doses were carefully measured.

SCOPE OF THE AUTHOR'S OBSERVATIONS

Of the 258 cases, 36 were not seen after the first treatment, so that the result could not be recorded. This leaves a total of 222 cases that remained under observation for at least a few months. Of these 222 cases there were 201 clinical cures, or 90 per cent. Fifteen patients, 6 per cent, improved, and in six cases, 2 per cent, the lesions were not even benefited. When it is considered that the cases were not selected and that at least one-half the failures were due to the patients' inability to have second or third treatments at

* Published simultaneously in *The Jour. of Cutaneous Diseases.*

proper intervals, or that the case was deemed practically hopeless when treatment was instituted, 90 per cent seems very satisfactory. As an illustration, several of the patients received a single treatment which did not suffice to effect a clinical cure. Then, on account of illness, old age, stormy weather, or other reasons, they did not return for the second treatment until the lesion was worse than it was at the beginning. In other instances the lesions were very deep and indurated, even involving the articulations or the entire orbit, and had received previous roentgen ray treatment. If one could omit such cases the percentage of cures would be in the neighborhood of 96 or 98 instead of 90.

Pre-epitheliomatous lesions are not included in this study. In other words, every case was distinctly an epithelioma from a clinical standpoint and they varied in size from a split pea to several inches in diameter, in duration from a few months to several years and either developed as a nodule or evolved from some pre-epitheliomatous lesion, usually a so-called seborrheic wart. In only a few cases was the diagnosis confirmed by the microscope, but in most instances the individuals were seen by dermatological confrères who agreed with the diagnosis. It would be senseless to biopsy every case of basal cell epithelioma because it is one of the easiest conditions for the dermatologist to recognize.

OCCURRENCE OF RELAPSES

Now regarding the question of relapses. Of the 201 clinically cured cases, 43 failed to remain under observation for six months. As will be seen later, most of the recurrences take place between six months and one year so that patients that are not observed for at least six months are of little statistical value so far as concerns the question of recurrence. We have, then, a total of 158 cured cases that were observed for periods of from six months to five or more years. In this series of 158 cases there were 24 relapses—15 per cent, leaving a total of possible permanent cures of 85 per cent.

A more critical analysis reveals that 16 cases were observed for five years or more with only one relapse—about 94 per cent of supposedly permanent cures. Forty-six cases remained under observation for four years. In this series there were nine relapses, leaving 80 per cent of probable permanent cures. Seventeen cases were followed for three years in which there were three recurrences—82 per cent cures. Of the two-year cases (about two years) there were 32, with five relapses—84 per cent cures. Thirty-four cases were observed for about one year with five recurrences—85 per cent cures. Thirteen cases were followed for six months—one relapse, 92 per cent cures. Finally, 43 cases were observed for from one to five months. In this series there were no relapses. Table 1 summarizes these statistics and enables the reader to grasp them at a glance.

TABLE 1.—CURES AND RELAPSES ARRANGED ACCORDING TO THE NUMBER OF YEARS UNDER OBSERVATION

Period of Observation	Number of Cases	Number of Relapses	Percentage of Cures
5 years.....	16	1	93.75
4 years.....	46	9	80.439
3 years.....	17	3	82.352
2 years.....	32	5	84.375
1 year.....	34	5	85.439
6 months.....	13	1	92.307
Less than 6 months...	43	...	100

In this connection it is interesting to note that most of the recurrences manifested themselves in less than a year. As indicated in Table 2, there were 24 cases of relapse, 18 (75 per cent) of which occurred in the first year. Four were noted in the second year and two in the third year. These findings are valuable as they tend to indicate that if the patient can be kept under observation for a year, and there has been no recurrence during this time, the chances are that a permanent cure has been established.

POSSIBILITY OF LATE RELAPSE

Inasmuch, however, as one relapse was noted as late as the third year, it is advisable to warn the patient of this possibility.

That there is not much likelihood of a récidive after the third year, in properly treated cases, is shown by the fact that 79 patients were observed for periods of from three to five years, and yet there was only one relapse that manifested itself three years after treatment. A study of this chart will also show that 19 of the 24 relapses were treated again with the roentgen ray, and that 17 recovered. The two cases that did not respond to the roentgen ray also did not improve under the influence of radium. Two of the recurrences were cured with radium and two by surgical excision. It will be noted that five cases relapsed a second time within a year after the second recovery. Four of these lesions again disappeared under further roentgen ray treatment and one failed to respond either to the roentgen ray or radium. To recapitulate, 17 out of 19 primary relapses responded immediately to the roentgen ray —two failed to get well. Only one out of the five second recurrences failed to recover. From this it will be seen that a relapse should not cause unnecessary alarm.

TABLE 2.—RELAPSES ARRANGED BY TIME OF OCCURRENCE

Relapsed at End of	Relapse Treated with	Result	Second Relapse at End of	Second Relapse Treated with	Result
3 months	Excision	Cured			
5 months	Roentgen ray	Cured			
6 months	Roentgen ray	Cured			
6 months	Roentgen ray	Cured			
6 months	Roentgen ray	Cured	4 months	Roentgen ray	Cured
6 months	Roentgen ray	Cured	1 year	Roentgen ray	Cured
6 months	Roentgen ray	Cured			
6 months	Excision	Cured			
6 months	Roentgen ray	Cured			
6 months	Roentgen ray	Cured	6 months	Roentgen ray	Failure
8 months	Radium	Cured		Radium	
8 months	Roentgen ray	Cured			
1 year	Roentgen ray, radium	Failure			
1 year	Radium	Cured			
1 year	Roentgen ray	Cured	1 year	Roentgen ray	Cured
1 year	Roentgen ray	Cured			
1 year	Roentgen ray	Cured			
1 year	Roentgen ray	Cured	1 year	Roentgen ray	Cured
1½ years	Roentgen ray	Cured			
1½ years	Roentgen ray	Cured			
2 years	Roentgen ray	Cured			
2 years	Roentgen ray	Cured			
2½ years	?	?			
3 years	Roentgen ray, radium	Failure			

EFFECT OF PREVIOUS TREATMENT

An attempt was made to ascertain if previous treatment altered the susceptibility of the lesion to intensive roentgenization. The result of this study is shown in Tables 2 and 3. There were 201 cured cases, of which the previous treatment was known in only 155. Three cases are omitted from the 21 failures because the previous treatment could not be ascertained, and four cases omitted from the 24 relapses for the same reason. The most noteworthy feature here is that 55 per cent of the failures were in cases that had been treated previously with the roentgen ray or radium, usually the roentgen ray in fractional doses over long periods of time. The percentages are obtained from the total number of cases as shown in the first column with the exception of the relapses. Here the "cured and not followed" cases were first deducted.

TABLE 3.—CURES, FAILURES AND RELAPSES ARRANGED ACCORDING TO PREVIOUS TREATMENT

Result	Number Cases	None	Excision	Caustics	Curettage, Cauterization	Roentgen Ray, Radium	Electricity
Cures....	155	83 54%	10 6%	22 14%	18 12%	16 10%	6 4%
Failures...	18	4 22%	1 6%	3 17%	0	10 55%	0
Relapses..	20	5 25%	2 10%	6 30%	0	5 25%	2 10%

Table 4 shows the results in relation to the number of treatments given. Only the cases with known end-results are recorded —222 cases.

TABLE 4.—RESULTS IN RELATION TO THE NUMBER OF TREATMENTS

Number Treatments	Number of Cases	Cures	Cured, Not Followed	Relapses	Failures
First treatment cases.....	74	74 33%	14 19%	3 5%	
Second treatment cases....	93	91 41%	17 19%	12 16%	2 0.009%
Third treatment cases....	32	27 12%	2 7%	5 20%	5 2%
Fourth treatment cases..	12	7 3%	2 29%	2 40%	5 2%
Fifth treatment cases....	7	3 1%	....	2 66.66%	4 1.8%
Sixth treatment cases....	4	2 0.009%	1 50%	....	2 0.009%

It will be seen from Table 4 that 74 cases, 33 per cent of the total of 222, were cured as a result of one treatment. Or, considering only the cured cases (201), 37 per cent were cured in one treatment, 45

per cent in two treatments, 13 per cent in three treatments, etc. It is interesting to note that four obstinate cases received as many as six intensive treatments with two cures and no relapses. The percentage of cures is high as far as the third treatment. It would seem from this, as would be naturally assumed, that if a lesion is not favorably influenced by two or three intensive treatments, the chances of producing a favorable result with the roentgen ray is materially lessened. The percentages are obtained from the number of cases treated with the exception of the relapses. Here the "cured and not followed" cases are first deducted from the total number of cases treated.

RELATIVE VALUE OF MEDIUM AND HIGH PENETRATION

An attempt was made to determine the relative value of a medium and a high penetration. Unfortunately, the number of cases receiving a "medium" ray was small as compared with the number treated with a "hard" ray. Nevertheless, Table 5, which records these observations, is not without value. The study is based on a total of 200 "cured" cases. The other cases are omitted because the quality of ray used was either not recorded or it was somewhere between "medium" and "hard."

TABLE 5.—RESULTS IN RELATION TO THE QUALITY OF RAY

Quality of Ray	Number of Cases	Cures	Relapses	Failures	Cured, Not Followed
B 6–7.....	22	22 100%	2 9%		
B 9–10.....	178	157 88%	18 15%	21 12%	33 21%

It will be seen that as a general proposition, the medium quality gives the best results as shown by the 100 per cent of cures against 88 per cent with the higher penetration. The percentage of relapses is obtained by first deducting the "cured and not followed cases" from the total number of cases. The other percentages are obtained from the number of cases treated.

Table 6 records the cures in relation to the number of individual treatments administered in both the B 6 and the B 10 cases.

TABLE 6.—B 6 AND B 10 CASES ARRANGED ACCORDING TO THE NUMBER OF TREATMENTS

Quality of Ray	No. of Cases	No. of Cures	Number of Treatments: One	Two	Three	Four	Five	Six
B 6–7	22	22	9 41%	9 41%	3 14%	1 4%		
10	5	5	9	7	7	5	5	9
B 9–10	178	158	61 38.5%	69 44%	19 12%	5 3%	3 2%	1 0.006%

The percentages in Table 6 are obtained from the number of cures. For instance, there were 178 cases receiving the B 9-10 ray of which 158 were cured. Sixty-one of these 158 cures were given one treatment only, so that 38½ per cent of the cures were the result of a single treatment. It will be seen here, too, the "medium" ray apparently has a slight advantage.

Thirty-five of the cases with known end-results were treated with a B 9-10 ray filtered through 3 mm. of aluminum. A comparison of the results obtained with the filtered and unfiltered ray (B 9-10 being used in all these cases) will be found in Table 7.

TABLE 7.—RESULTS IN FILTERED AND UNFILTERED CASES

	Number of Cases	Cures	Cured, Not Followed	Relapses	Failures
Filtered.....	35	21 60%	3 14.285%	6 35%	14 40%
Unfiltered.....	147	141 96%	30 21%	13 11.666%	6 4%

The study outlined in Table 7 does not give the true comparative value of the two methods because, as a rule, the lesions that received filtered treatments were more deeply seated, larger and more indurated than were the lesions treated without the filter. The percentage of relapses are obtained after deducting the "cured and not followed" cases from the total number of cures. The other percentages are taken from the total number of cases.

NUMBER OF TREATMENTS REQUIRED

Some idea of the difference in malignancy or obstinacy of the lesions may be obtained by a glance at Table 8 which

shows the number of treatments necessary in individual cases both with the filtered and the unfiltered ray.

TABLE 8.—FILTERED AND UNFILTERED CASES ARRANGED ACCORDING TO THE NUMBER OF TREATMENTS

	Number of Treatments											
	One		Two		Three		Four		Five		Six	
	Filt.	Unfilt.	Filt.	Unfilt.	Filt.	Unfilt.	Filt.	Unfilt.	Filt.	Unfilt.	Filt.	Unfilt.
Number cases.	3	59	10	63	7	18	5	6	7	..	3	1
Cures.....	2 6%	58 40%	9 25%	62 42%	4 12%	16 11%	2 6%	4 3%	3 8%	.. ..	1 3%	1 0.006%
Relapses.....	.. ..	2 5%	2 28%	8 16%	2 50%	1 7%	.. ..	2 50%	2 66.66%			
Failures.....	1 3%	1 0.006%	1 3%	1 0.006%	3 8%	2 1%	3 8%	2 1%	4 12%	.. ..	2 6%	
Cured, not followed.....	.. ..	14 24%	2 22%	13 21%	.. ..	2 12.5%	.. ..	.. ..	. ..	.. ..	.. ..	1 100%

The key to Table 8 is as follows:

In the first vertical column there were three out of a total of 35 filtered cases that received only one treatment. Of these three cases, two were cured and one failed to improve. Therefore 6 per cent of the 35 filtered cases were cured in one treatment. The total 35 is obtained by adding the various filtered totals in the first horizontal column. In the second vertical column we find that 59 out of 147 unfiltered cases received one treatment. Fifty-eight of these patients were cured; in other words, 39 per cent of the total number of unfiltered cases were cured in one treatment. The failure percentage is also taken from the total 147, but for the relapses the "cured and not followed" cases (14) are deducted from the 58 cures and the percentage obtained from the remaining 44 cases that were cured and that remained under observation.

After eliminating the cases with unknown results there was a total of 43 lesions that were curetted immediately preceding the application of the roentgen ray. The curettage was very superficial, consisting of the removal of crusts, nodular masses and indurated borders. Table 9 gives a comparison between the results obtained in cases that were and those that were not curetted.

TABLE 9.—COMPARISON OF RESULTS IN CURETTED AND NONCURETTED CASES

	Number of Cases	Cures	Cured, Not Followed	Relapses	Failures
Curetted.....	43	38 88%	5 13%	5 15%	5 12%
Not curetted.....	179	163 91%	31 19%	19 15%	16 9%

The percentage of relapses, as in the other tables, to be of true statistical value, have been obtained after subtracting the cured cases that failed to remain under observation from the total of cured cases.

The other percentages are obtained from the totals in the first vertical column. It will be seen that there is not much difference in percentage between the cures that followed curettage and those that were not curetted. There is, however, considerable difference in the number of cases that were cured in one treatment, a matter of no little importance as will be shown later. Table 10 gives at a glance the number of treatments required in the curetted and noncuretted cases.

The percentages in Table 10 were obtained exactly as in Table 8. Here we see that 51 per cent of the total number of curetted cases was cured in one treatment as against 28 per cent of the cases that were not curetted.

EFFECT OF LOCATION ON RESULTS OF TREATMENT

On account of the frequent statements to the effect that epitheliomas in certain locations are particularly recalcitrant it was thought advisable to classify the results according to locations. Table 11 provides these statistics.

According to Table 11 the most stubborn lesions are those located at the inner canthus. Here we find 79 per cent cures, 26 per cent relapses and 20 per cent failures, as against 92 per cent cures, 7 per cent relapses and 8 per cent failures for lesions

TABLE 10.—CURETTED AND NONCURETTED CASES ARRANGED ACCORDING TO THE NUMBER OF TREATMENTS

	Number of Treatments											
	One		Two		Three		Four		Five		Six	
	Curetted	Not Curetted	Curetted	Not Curetted	Curetted	Not Curetted	Curetted	Not Curetted	Curetted	Not Curetted	Curetted	Not Curetted
Number cases	23	51	10	82	5	27	2	10	2	5	1	4
Cures	22 51%	50 28%	10 23%	80 45%	4 9%	23 13%	1 2%	6 3%	1 2%	2 1%	.. ..	2 1%
Relapses	1 5%	2 5%	2 22%	11 17%	1 33.33%	3 14%	.. ..	2 50%	1 100%	1 50%		
Failures	1 2%	1 0.006%	.. ..	2 1%	1 2%	2 2%	1 2%	4 2%	1 2%	1 1.66%	1 2%	2 1%
Cured, not followed	.. ..	11 22%	1 10%	16 20%	1 25%	1 4%	.. ..	2 33.33%	.. ..	.. ..	.. ..	1 50%

on the cheek. The following is the key to Table 11:

Refer to the nose cases (first transverse column). The total number of cases is 61. This includes the cures (59) and the failures (two). The unknown cases (patients not reporting after the cessation of treatment) are not included. The percentages of cures and failures are taken from the total 61. The percentage of relapses is obtained from the cures after deducting the "cured and not followed" cases.

CASES GROUPED ACCORDING TO CLINICAL TYPE

A compilation of statistics based on the clinical characteristics of the lesions offers material of prognostic value. In Table 12 an attempt has been made to divide the cases into groups possessing distinct clinical characteristics. The nodular lesions were those which consisted of a single nodule or a group of coalesced nodules. These lesions, while at times quite thick, were for the most part superficial. They ranged in size from a split pea to a dime and, occasionally, a quarter. They were not ulcerated and not crusted. The ulceronodular lesions were nodular lesions which had undergone more or less ulceration. Many of these lesions were as large as a 50-cent piece and some were the size of a silver dollar. The superficial ulcers were lesions ranging in size from a split pea to a silver dollar, free of nodules and induration. At times these consisted of hardly more than a superficial erosion covered with a crust. The deep, indurated ulcers in size ranged from a silver quarter to an adult hand. The induration was dense and the ulceration extended into the subcutaneous tissue, and in many instances involved the muscles and other important structures. The infiltrated plaques represent split-pea to quarter-sized areas of adherent hyperkeratosis with underlying infiltration. The verrucous lesion is the infiltrated plaque just mentioned with a papillomatous or verrucous surface.

TABLE 11.—RESULTS ARRANGED ACCORDING TO LOCATION

	Number Cases	Cured	Cured, Not Followed	Relapse	Failure
Nose	61	59 = 97%	10 = 17%	10 = 20%	2 = 3%
Internal canthus	24	19 = 79%	1 = 5%	5 = 28%	5 = 21%
Exterior canthus	8	7 = 87.5%	3 = 43%	.....	1 = 12.5%
Forehead	35	32 = 91%	4 = 12.5%	6 = 21%	3 = 9%
Eyebrow	3	3 = 100%			
Cheek	37	34 = 92%	7 = 21%	2 = 7%	3 = 8%
Lip	8	7 = 87.5%	3 = 43%	.....	1 = 12.5%
Chin	14	13 = 93%	4 = 31%	.....	1 = 7%
Ear	5	5 = 100%	.....	1 = 20%	
Behind ear	7	7 = 100%	1 = 14%		
Eyelid	6	6 = 100%	2 = 33.33%		
Neck	8	8 = 100%	.....	1 = 12.5%	
Trunk	6	5 = 83%	1 = 20%	.....	1 = 16.66%
Hand	4	4 = 100%			

The Key to Table 12 is as follows:

In the first horizontal column is shown the result obtained in the nodular type of epithelioma of which there were 67 cases which were kept under observation for at least a few months. The percentage of cures and failures are obtained from this total. The percentage of relapses is obtained from the cures after deducting the "cured and not followed" cases.

It will be seen that the highest percentage of cures and the smallest number of failures were obtained in the infiltrated plaques. This is also true of the relapses. Of the well developed epitheliomas Table 12 shows that the best results were obtained in the superficial ulcers. Next comes the nodular and then the ulcero-nodular cases.

TABLE 12.—RESULTS ARRANGED ACCORDING TO THE CLINICAL TYPE

	Number of Cases	Cures	Cured, Not Followed	Relapses	Failures
Nodular	67	65 97%	13 20%	8 15%	2 3%
Superficial ulcer	16	16 100%	3 19%	4 31%	
Ulceronodular	84	78 93%	12 15%	7 11%	6 7%
Deep, indurated ulcer	43	30 70%	7 23%	6 26%	13 30%
Infiltrated plaque	12	12 100%	1 8%		
Verrucous	1	1 100%			

NUMBER OF TREATMENTS GIVEN VARIOUS CLINICAL TYPES

Table 13 shows the number of treatments administered to the various clinical types. Only the cured cases and the failures are recorded. It will be noted that 62.5 per cent of the superficial ulcers responded to one treatment as against 40 per cent for the nodular, 28 per cent for the ulceronodular, and 14 per cent for the deep, indurated ulcers. The infiltrated plaques show the best results with a percentage of 91.66.

TABLE 13.—LESSONS OF VARIOUS CLINICAL TYPES ARRANGED ACCORDING TO NUMBER OF TREATMENTS

Clinical Appearance	Number Cases	Number of Treatments					
		One	Two	Three	Four	Five	Six
Nodular	68	27 40%	29 43%	7 10%	3 5%	1 1%	1 1%
Superficial ulcer	16	10 62.5%	3 18.75%	3 18.75%			
Ulceronodular	85	24 28%	39 46%	13 15%	4 5%	4 5%	1 1%
Deep, indurated ulcer	43	6 14%	18 42%	11 25%	4 9%	2 5%	2 5%
Infiltrated plaque	12	11 91.66%	1 8.33%				
Verrucous	1	..	1 100%				

DEGREES OF REACTION OBSERVED

Table 14 shows the effect of varying degrees of roentgen ray reaction on the epitheliomas. Omitting the third degree reactions and the cases showing no reaction, on account of their small numbers, we find that the highest percentage of cures and the smallest percentage of failures and relapses occurred in connection with reactions of the second degree. The percentage of relapses is particularly misleading in this instance, because 53 per cent of the cured cases following a first degree reaction failed to remain under observation as compared with only 18 per cent in the second degree cases. The percentages in this table were obtained in the same manner as in Table 12.

TABLE 14.—RESULTS ARRANGED ACCORDING TO THE REACTION

Reaction	Number of Cases	Cures	Cured, Not Followed	Relapses	Failures
No reaction	5	4 40%	1 25%	....	1 20%
First degree	59	43 73%	23 53%	18 90%	16 27%
Second degree	25	22 88%	4 18%	3 16.66%	3 12%
Third degree	2	2 100%			

EFFECT OF AGE ON RESULTS

Table 15 records the results in individuals of different ages. These statistics indicate the best results in young people, but the number of cases was too small to be of value. The next best showing was between the ages of 50 and 60, although when the table is carefully studied it is seen that age makes very little difference. The percentages were estimated in the same manner as those in Table 14.

EFFECT OF SEX ON RESULTS

The last table (Table 16) shows the results in relation to sex. The best results were obtained in females. The percentages here were obtained in the same manner as those of the preceding table.

STATISTICS FOUND IN THE LITERATURE

While there is a voluminous literature dealing with the roentgen-ray treatment

of cutaneous basal cell epitheliomas there are very few articles that give carefully compiled statistics. Pusey's[17] stastitics, published in 1907, do not differentiate between the basal cell and squamous

TABLE 15.—RESULTS IN RELATION TO AGE

Age	Number of Cases	Cures	Cured, Not Followed	Relapses	Failures
From 20 to 30.....	3	3 100%	1 33.33%		
From 31 to 40.....	25	21 84%	7 33.33%	2 14.285%	4 16%
From 41 to 50.....	64	58 91%	10 17%	6 12.5%	6 9%
From 51 to 60.....	56	53 95%	8 15%	9 20%	3 5%
From 61 to 70.....	32	28 87.5%	10 36%	3 16.66%	4 12.5%
From 71 to 85.....	23	20 87%	..	..	3 13%

TABLE 16.—RESULTS IN RELATION TO SEX

Sex	Number of Cases	Cures	Cured, Not Followed	Relapses	Failures	Unknown
Male.....	110	96 87%	19 20%	12 16%	14 13%	22 20%
Female...	113	105 93%	17 16%	12 14%	8 7%	12 11%

cell types. In reading this article one gains the impression that most of the cases were of the basal cell variety. The report was based on 111 cases that were observed from three to six years. Four of the failures were clinically cured but relapsed.

Cured	80
Benefited	19
Failures	12
Total	111

Including under the heading of "cured" the four cases that relapsed, there were 84 cures in a total of 111 cases, 76 per cent. The percentage of relapse was 5. The roentgen ray was applied in fractional doses.

E. G. Williams[18] reported 53 cases of probable basal cell tumors, treated by the fractional technic. Of the 53 lesions, 52 healed under the influence of the roentgen ray. Nine patients were not seen again after they were clinically cured. Twelve cases were not observed for six months. The remainder, 32 cases, were followed for from six months to four years. There were six recurrences—three in the first year and three in the second year. They all healed a second time under the influence of the roentgen ray. In one case there were two recurrences and the lesion was clinically cured each time by a continuation of the same treatment.

Cures	52	Cures (observed more than six months)	31
Failures	1	Relapses	6
	—	Per cent relapses	19
Total	53		

In August, 1909, Sequeira[19] reported the results obtained by roentgenotherapy in 236 cases of basal cell epithelioma which were treated in the period between June, 1900, and Dec. 31, 1905. The fractional technic was employed.

Cured (under observation from three to six years)	75	
Cured (under observation for at least two years)	26	
Cured—relapsed—ultimately cured	31	
Cured—relapsed and failed to respond	7	
Total number of clinical cures	—	139
Improved—never quite healed	19	
Very little influenced	16	
Spread in spite of rays	7	
	181	

The percentage of cures was 66. Of the 139 cures, 38 relapsed, making a percentage of recurrences of 27.

C. M. Williams,[20] in 1905 and 1906, reported 16 cases of basal cell epithelioma of which 11 were clinically cured—a percentage of 68.75. Two of the 11 cures relapsed (18 per cent), one at the end of seven months and the other in the second year. The patients were observed for a period of three years. The treatment was fractional. Most of the failures were in deep-seated, indurated rodent ulcers.

Stern[21] reports 85 cases of rodent ulcer treated with fractional roentgen-ray doses. In many of the cases the high frequency spark was employed to destroy the indurated edge. Forty-five of the 85 cases (53 per cent) were clinically cured. Nothing is known regarding relapses, as the patients were not kept under observation. Hahn[22] claims that he has cured 95 per cent and Schultz[23] 90 per cent of their cases of rodent ulcer, but they do not publish their sta-

tistics. Dachtler,[24] in 1917, published statistics based on the roentgen-ray treatment of 509 cases of cutaneous epithelioma. He does not separate the tumors into basal and squamous cell varieties, but it can be assumed that most of them were of the basal cell type, although many of them, as some of those of the lips (mucous surface), must have been of the squamous cell variety. Pre-epitheliomas were not included in the report.

The technic is not mentioned, but it probably consisted of fractional doses. The results are as follows:

Location	Males	Females	Total	Cured
Eyelids	98	47	145	134
Nose	61	49	110	102
Cheek	60	35	95	81
Lower lip	55	2	57	52
Forehead	17	27	44	43
Ear	22	3	25	20
Upper lip	12	6	18	16
Chin	6	2	8	8
Neck	7	..	7	7
	338	171	509	463

Dachtler does not include relapses in his statistics, but many of the patients were observed for from two to six years, and one gains the impression from a perusal of the article that there were few if any recurrences. The total percentage of cures was 91.

COMMENT

It will be seen that the lowest percentage of clinical cures in any of the statistics is 53 (Stern), while they run as high as 98 per cent (E. G. Williams). The lowest percentage of relapses was 5 (Pusey); the highest was 27 (Sequeira). It is of little practical value to compare these statistics, for some of them are incomplete, they treat the various items differently; some of them include both the squamous and basal cell types, while others do not, and the technic of the various authors differs materially. For the same reason it is impractical to endeavor to obtain a mean average of temporary and permanent cures. Most roentgenologists agree that it is possible to obtain as high as 98 per cent of clinical cures and from 94 to 96 per cent of permanent cures in selected cases of basal cell epithelioma and from 80 to 90 per cent of permanent cures in unselected cases.

In the author's statistics of unselected cases there was a percentage of clinical cures amounting to 90 with 15 per cent relapses. Most of the recurrences, however, responded to further treatment so that the original percentage of 90 is not materially reduced. It will be recalled that the cases that were observed for five years showed a percentage of permanent cures of 94; four-year cases, 80 per cent; three-year cases, 82 per cent; two-year cases, 85 per cent. These percentages can be increased by omitting the recurrences that again healed under the influence of the roentgen ray.

COMPARISON OF METHODS OF TREATMENT

Now let us see how these statistics compare with those associated with other methods of treatment. Hazen[25] reports a series of 178 basal cell epitheliomas which were treated by surgical excision. Twenty-eight patients were his own, the remainder being borrowed from the service of Dr. Bloodgood at the Johns Hopkins Hospital.

Sixty-four patients were kept under observation for more than three years. Four of these patients were well at the end of three years; 13 at the end of four years; 39 after five or more years. In seven instances there was a recurrence. This gives a percentage of permanent cures of 86 in the unselected cases. There were five practically hopeless cases, and if these are omitted and only the selected cases considered, the percentage of cures will amount to 93. A further study of the treated cases, as regards the duration and the extent of the lesion, gives the following data:

Duration	Cured	Recurrent
1 year	17	2
2 years	8	..
3 years	9	..
5 years	12	3
10 years	17	3
Size	**Cured**	**Recurrent**
Under 1 inch	33	2
From 1 to 2 inches	19	2
Extensive	4	4

It will be seen that there is really very little difference, according to statistics, between the results obtained by surgical excision and by the roentgen ray. Sherwell[26] obtained 90 per cent of permanent cures in unselected cases with the vigorous use of acid nitrate of mercury after a thorough curettage, but this estimation is not based on carefully compiled statistics. The literature does not appear to contain statistics based on the use of the various caustics such as arsenic, zinc, carbon dioxid snow, actual cautery, desiccation, etc. It has been claimed by A. Robinson and others that arsenical paste, if properly employed, gives as high a percentage of permanent cures as does any other method. And it is the consensus of opinion among dermatologists that a vigorous-acting caustic if thoroughly applied constitutes an excellent method of treatment. On the other hand, there seems to be very little confidence in carbon dioxid snow, superficial caustics, electricity and similar agents.

THE METHODS OF CHOICE

So far as concerns statistics the best results are associated with excision and with the roentgen ray, and as has been shown, the figures are very much the same in both instances if the work is properly done. Let us assume, therefore, that as far as concerns the prognosis, there is no choice between the two methods. Neither method can be carelessly undertaken. If the roentgen ray is to be applied it should be administered by one who possesses the ability and the means of employing a modern technic. In surgery there is only one difficulty, and that pertains to the complete removal of all diseased tissue. It is obvious that if all the malignant cells are removed there can be no relapse. The tendency, however, in order to obtain a good cosmetic result, is to cut too close to the macroscopic lesion. In a number of instances the author has obtained the excised tissue *in toto*, cut it serially and found that the proliferated epithelial cells extended right to the edge of the incision. It is a question if such an examination should not always be made and then if the indications warrant it, the roentgen ray can be employed to prevent recurrence.

OCCURRENCE OF SCAR FORMATION AFTER TREATMENT

In small epitheliomas, lesions that can be excised and the wound made to heal by primary intention and particularly if the subcuticular stitch is employed, the resulting linear scar is hardly discernible. In instances when there is considerable ulceration, the deformity subsequent to excision and primary union may be less than after the use of the roentgen ray, as the destruction of tissue by the ulcerative process may necessarily leave a scar. On the other hand, when there is not ulceration, or the ulceration is very superficial, it may be impossible to locate the site previously occupied by the lesion after a cure has been effected by roentgenization. In considering the cosmetic possibilities it is well to bear in mind that the amount of ray necessary to effect a complete cure may in some individuals produce subsequent wrinkling or telangiectasia or both. Furthermore, one must admit the slight possibility of overtreatment with the production of a serious chronic radiodermatitis.

RESULTS IN THE AUTHOR'S CASES

In the author's series of 258 patients there were only two cases of noticeable wrinkling and six cases of telangiectasia. This is in marked contrast to the number of instances of telangiectasia following the roentgen-ray treatment of other affections such as keloid, in which the ray was allowed to come in contact with the normal skin beyond the edge of the lesion. Perhaps this can be explained by the fact that in keloid, as a rule, one is dealing with younger subjects, or it might be a pure coincidence. Telangiectasia following a single erythema dose or subsequent to an erythema provoked by fractional doses is not a rare phenomenon, and it is curious

why it does not occur oftener in epithelioma in which considerable normal skin is exposed to one or more erythema doses. There were two cases of third degree radiodermatitis of small extent, both of which healed in a few months.

DISADVANTAGES OF SURGICAL INTERFERENCE

The surgeon, working with the knife, is at a disadvantage in extensive lesions in which it is difficult, if not impossible, to remove all the diseased tissue and in which the resulting wound must be allowed to heal by granulation, or in which skin grafting or a skin flap is necessary. Nevertheless, remarkable results can be obtained in such cases by a clever surgeon.

COMPARING OF RESULTS

It is unfortunate that no statistical comparison can be made with the results obtained by the use of curettage and strong chemical or electrical caustics. These methods do not yield as good cosmetic results as does the roentgen ray in small lesions, but in large, ulcerative lesions there is very little choice from the standpoint of cosmetics.

PRIMAL OBJECT IN ALL TREATMENT

In the treatment of epithelioma the main requisite is the complete destruction of the lesion—not a single malignant cell must remain. The cosmetic result while worthy of consideration is of secondary importance. Let us assume that the average basal cell growth can be cured by excision, roentgen ray or radium, or by very powerful caustics. This being true the author favors the roentgen ray or radium because there is no pain nor inconvenience to the healthy, active individual and no physical shock to the aged or weak patient. However, after one has had long experience in the use of these various methods of combating the disease he is likely to select the treatment or combination of treatments apparently most suitable to the individual case. In superficial lesions the author favors the roentgen ray and radium because of the good cosmetic results, the high percentage of permanent cures, and because there is no pain or inconvenience or loss of time to the patient. Lesions situated at the inner canthus, on the eyelids or on the nasal alæ are especially suitable for roentgenotherapy or radium therapy on account of the difficulty of applying adequate surgical methods to these locations. Extensive, deep-seated growths, especially when markedly indurated, are likely to prove very recalcitrant and such lesions can very often be most successfully combated by the use of the knife, the curet, chemical caustics, fulguration (desiccation) or the actual cautery, followed by one or two intensive applications of radium or the roentgen ray. Not only will this procedure add to the certainty of a prompt, permanent cure, but it will remove the necessity of a relatively large number of very intensive doses which would occupy considerable time and which might lead to undesirable sequelæ.

PROGNOSIS DEPENDS ON EFFECT OF PREVIOUS TREATMENT

It is well known that the previous treatment affects, to some extent, the prognosis. Table 3 shows that the most stubborn lesions are those that have received repeated courses of fractional roentgen-ray treatment. For this reason it would seem advisable, in selecting a method or a combination method to carefully consider the previous treatment and its result. If, for instance the skin in the neighborhood of the lesion shows roentgen-ray sequelæ (atrophy, telangiectasia, or similar conditions) it would seem advisable to employ some procedure other than the roentgen ray or radium. Finally, if a lesion does not respond at once to intensive radiation it is advisable to utilize some other method instead of proceeding with roentgenization indefinitely. Some roentgenologists will not agree with this statement. They are con-

vinced that every basal cell epithelioma can be cured with the roentgen ray or with radium if the dose is sufficiently intensive, the treatment being pushed to the point of producing a third degree radiodermatitis if necessary. In confutation of this opinion the author has studied tissue removed from roentgen ray ulcers (on the site of a basal cell epithelioma) of long duration and found actively proliferating epithelial cells deep in the tissue or at the edge of the ulcer.

TECHNIC OF APPLYING THE ROENTGEN RAYS

Now comes the question of choice of technic—intensive or fractional. Those who have watched the evolution of roentgenotherapy of epithelioma will admit that the tendency has been to intensify the technic. Years ago all operators employed the fractional method and it was indeed, with a few exceptions, very fractional. That is, in those days, it required from 25 to 50 or even more treatments to cause a small rodent ulcer to heal. The men who now employ the fractional technic accomplish the desired result in from six to twelve applications. Comparatively speaking, this is intensive treatment. The author has a very vivid and rather sad recollection of his early experience with the use of the fraction method in the treatment of basal cell epithelioma. Unfortunately, he kept no careful records at the time, and those that he did preserve were lost. The results were very poor and they remained poor until a more intensive technic was developed. As a matter of fact, the end-result of the roentgen-ray treatment of epithelioma was so bad at that time that it was difficult to obtain permission in New York to treat a case with the roentgen ray. In this connection, American roentgenology owes a debt of gratitude to Dr. William A. Pusey. While always an advocate of the fractional technic, comparatively speaking his treatment was intensive. And it was largely due to the persevering efforts of this well known dermatologist in making the profession acquainted with the possibilities of the roentgen ray in the treatment of epithelioma, that confidence in the work was finally restored.

While his percentage of permanent cures was only 76, it must be remembered that he included prickle cell cancer, that the cases were unselected, and that his results were given in 1907, at a time when roentgenologists were laboring under great disadvantages.

IMPORTANCE OF INTENSIVE TREATMENT

The literature does not seem to contain statistics based on a truly intensive treatment of basal cell epithelioma. The author admits that Dr. Pusey and many other men can equal, with the fractional technic, his statistics, but he does insist that for a good showing in a large number of cases it is essential that a reasonably intensive treatment be employed. And this is the opinion of the majority of roentgenologists.

The author's experience with the fractional technic of former years, with the fractional technic of to-day and with the intensive technic has led to a firm conviction that the last mentioned method offers the greatest advantages in the roentgen-ray treatment of epithelioma. It is fairly well agreed now that small doses of roentgen ray may actually stimulate a neoplasm and produce a more rapid growth. Furthermore, these small doses applied over a long period of time, may in some way cause the cell to resist the beneficial influence of the ray. These facts may explain, theoretically at least, why so many tumors improve for awhile under small doses and then grow steadily worse in spite of a continuation of the treatment. And it may also explain why such cases fail to yield to intensive roentgenization.

In this connection the author has noted that if a lesion has failed to respond to the old-fashioned fractional method and then several months or a year or two elapse without treatment, the lesion is more likely to respond to intensive roentgenization than when this treatment is administered immediately on the cessation of the fractional treatments. While the author has no figures

to prove it, his results have been very much better with the intensive than with the fractional technic and the increase in the percentage of permanent cures has apparently been directly proportionate with the increase in the intensity of the treatment, at least up to a certain point. Even with the fractional technic of to-day there is a theoretical stimulation with the first few applications, but the accumulative effect is probably sufficiently rapid to prevent injurious stimulation.

Speaking from personal experience the author has found that relapses following intensive treatment respond more readily to further intensive treatment than did the recurrences following his former fractional technic. In Table 2 is recorded nineteen relapses, seventeen of which were again clinically cured by one or two intensive treatments. Five of these cases again recurred, four of which again responded to further intensive treatment and have remained well for at least two years. Such results were not obtained years ago by the author although both Drs. Pusey and Williams succeeded in curing the same proportion of récidives with a fractional technic.

MAXIMUM SKIN TOLERATION APPLICATIONS ADVISABLE

There is another point that possibly favors intensive technic and that should receive some consideration. By administering a skin toleration dose it is possible to secure many small epitheliomas in one treatment. In the author's statistics 37 per cent were cured as a result of one application. For the sake of argument let us assume that this intensive dose for epitheliomas is H 2 B 10. Now, if this amount of ray is divided into fractions of H ¼ B 10 and administered twice weekly, it is likely to require H 3, H 4 or even more to bring about the same result. In other words, with the fractional technic the total dosage is greater than with the intensive method and as a rule the smaller the individual doses the greater will be the total dose. It is doubtful if this fact is of much practical importance, if the lesion is cured in a relatively few treatments as, for instance, when H ¼ or H ½, B 10 is given twice weekly. But when the fractions consist of H ⅛, 1/16 or less, the total dose is likely to be as high as H 15 or 20. Even here, the poor results may not be caused by the high total dosage, but rather to the fact that for the first few weeks or months of such treatment the malignant tissue is stimulated and made more resistant.

PRELIMINARY CURETTAGE

Until proof to the contrary is elicited it would seem, from a scientific point of view, preferable to cure a case with a minimum rather than with a maximum amount of ray. And it is for this reason that the author favors the use of some preliminary measure such as the curet in indurated or markedly nodular lesions. Table 10 strengthens this statement for we see that in the cases that were not curetted the percentage of cure as a result of one treatment was 28 as against 51 per cent in the curetted cases. There is no objection, other than cosmetic, to the use of the curet under local anesthesia in this type of epithelioma because there is no danger of metastasis.

The saving of time for the patient is at times of the utmost importance and certainly, if a lesion can be cured in one or two instead of many treatments, the individual is spared a great deal of trouble and time.

CAUSES OF FAILURES

While the intensive treatment, as a rule, fails only in lesions that are considered rather hopeless from the start, nevertheless, small, superficial lesions are at times remarkably rebellious and occasionally refuse to heal. These lesions, clinically and histologically, are identical with the growths that yield readily to the roentgen ray and it is impossible to formulate a satisfactory explanation for such failures. Many of the cases of this particular type in the author's practice were situated on the nose and for

awhile it was thought that location might influence the outcome but the statistics, as shown in Table 11, do not support this contention. These statistics show that the most rebellious lesions were situated at the inner canthus, while both Sequeira and Dachtler had the greatest trouble with lesions on the cheek.

QUALITY OF THE ROENTGEN RAY

In the selection of the kind of ray, quality is possibly a matter of more importance than roentgenologists have been willing to admit. The author is not aware of any carefully conducted experiments to determine the best quality of ray for the different clinical types of basal cell epithelioma. He has employed a B 10 ray as a routine because it was thought that the higher penetrations allowed a greater margin of safety and because the results seemed satisfactory. It will be recalled that Table 5 showed 100 per cent clinical cures and 9 per cent relapses with a B 6 ray as against 88 per cent clinical cures and 15 per cent of relapses with a B 10 ray. Acknowledging the fact that statistics are more or less unreliable, but accepting them at their face value, the "medium ray" in this instance has a decided advantage.

Schultz[27] has succeeded in curing epitheliomas with very "soft rays" that failed to respond at all to a ray of greater penetration. He avers that the quality of ray employed should be in accordance with the specific gravity of the tumor mass. Regardless of the reason for this phenomenon, it is a fact that a superficial epithelioma that has failed to improve under the influence of roentgen rays of medium or hard penetration, may heal as a result of an intensive application of the beta rays of radium. It is possible, therefore, that "medium," "soft" and very "soft" roentgen rays are indicated in certain cases. That they are not indicated in all cases is demonstrated by the fact that an occasional tumor will respond better to a well-filtered hard ray than to rays of lower penetration. It is possible that both the depth and density of the lesion are deciding factors. In deep and indurated lesions the dose that reaches the lowermost part of the growth when a "low ray" is used, may be relatively small and just about enough to stimulate rather than retard the growth. It is quite possible, therefore, that the quality should be selected that is best suited to the individual case. Before this can be done with reasonable certainty considerable experimental work will be required. Basing an opinion on what is already known, it would seem that a "soft" ray would be most suitable for the superficial, nonindurated growths and the filtered "hard" ray for deep-seated, dense, indurated lesions.

GOOD COSMETIC EFFECT DESIRED

While the cosmetic result in the treatment of epithelioma is of secondary importance, yet, when it does not interfere with the cure of the disease, one is justified in attempting a pleasing result from a cosmetic point of view. It will not do, of course, to limit the exposure to the macroscopic lesion. The surrounding skin, also, must be treated, and if an erythema is provoked telangiectasia may follow. Telangiectasia may be avoided by administering suberythema doses at suitable intervals, or, if one is dealing with an ulcer, a full erythema dose can be applied to the lesion and a suberythema dose to the surrounding apparently normal skin. The author's practice is to administer H 2 B 10 (skin distance) to the lesion and to the normal skin for from ¼ to ½ inch beyond the clinical manifestation of the growth and H 1¼, B 10 (skin distance) to the normal skin for an additional ½ or 1 inch. H 2, B 10 (skin distance) will almost always produce at least a pronounced erythema and sometimes a dermatitis and even vesiculation, depending on the location, age, complexion, sex and similar factors.

In aged individuals or if the lesion is deep or markedly indurated, the dose is often increased to H 2¼, B 10 (skin distance), or even H 2½ (skin distance).

The smaller dose of H 1¼ to the normal skin will not, as a rule, produce more than a faint and transitory erythema. If it is necessary to make the application to the mucosa the dose is reduced to about H 1½ because the mucous membranes are more susceptible than is the skin. When a ray of a quality of B 10 is filtered through 3 mm. of aluminum the dose may be increased. Here the minimum dose would be H 2 and the maximum H 3. If the quality is lowered it is advisable to also reduce the quantity. The intensive treatments are administered at intervals of from four to six weeks unless erythema persists, when a longer rest is allowed.

If there is not a marked response to the first treatment it is advisable to alter the quality for the second application, either using less penetration or greater penetration according to the character of the lesion and to urge or even insist on the use of the curet and, finally, if the result is not satisfactory after the second intensive dose, the question of excision or some other reliable surgical procedure should be seriously considered.

For the fractional technic H ¼ B 10 (skin distance) unfiltered, twice weekly, or H ½ once weekly, will provoke a faint erythema, as a rule in about a month, and a well pronounced erythematous reaction in from six to eight weeks. H ⅓ twice weekly should effect a well marked reaction in about a month. If a filter is used the dose can be increased a little.

It is important that the normal skin, the hairy parts, the eye and other important organs be suitably protected with lead foil.

TREATING LARGE LESIONS

When dealing with large lesions—the size of a palm or an adult hand—the margin will receive a smaller dose than will the center of the growth on account of the increased distance and the fact that it is only the oblique ray that reaches the edge of the diseased area. To insure a fairly equal distribution of the dose in such instances it is advisable to divide the affected area into from two to four squares and administer a full dose to each square, care being taken not to allow overlapping. When the growth is situated on the upper eyelid the eye is cocainized and a piece of gauze saturated with bismuth paste is placed between the lid and the eyeball. Unless involved in the growth, the edge of the lid is also covered with the paste in order to protect the eyelashes.

Being cognizant of the experimental work conducted by Murphy at the Rockefeller Institute the author treated a few cases of basal cell epithelioma by exposing the general surface of the body to the roentgen ray. He was unable materially to increase the percentage of lymphocytes and there was no appreciable improvement in the lesions. Very little is known about the practical application of this method and perhaps further observation and experimentation will lead to better results.

EFFECT ON THE SURROUNDING TISSUE

In a few cases of basal cell epithelioma an erythema dose, while having the desired effect on the growth, appeared to produce a temporary overactivity of the sebaceous glands and of the epidermis which was manifested by the formation of thick waxy scales. It was noted that this phenomenon occurred only on the face. In one instance wart-like growths developed but disappeared in a week or two. It is possible that these phenomena represent either an overzealous or an abnormal attempt at repair. Occasionally, after the disappearance of the epithelioma, the former site of the lesion will be scaly for a number of months. In such instances a soothing ointment may be applied, but stimulating and irritating applications are contraindicated, as such measures are likely to provoke a dermatitis weeks and even months after cessation of roentgenization.

RADIUM

Unfortunately, the author has been unable to locate statistics showing the results of applying radium in the treatment

of basal cell epithelioma. Those who have employed both agents agree that the results are similar. Some claim that radium is superior and others that the roentgen ray is preferable. In the absence of statistics the author will be guided by his own experience.

AUTHOR'S OBSERVATIONS

In the first place radium will occasionally succeed after the roentgen ray has failed. In such instances the result has been achieved by the use of the beta-rays. In no instance has the author been able to effect a cure with the roentgen ray when radium failed. Furthermore, in cases in which the roentgen ray proved inefficacious the gamma-rays of radium also failed to be effective. The number of cases treated is too small and the length of time too short to make the statistics of any value. The impression gained is that for small, superficial lesions the more penetrating of the beta-rays are superior to the gamma-rays of radium, and the reverse is true for deep-seated, indurated growths. It is also the opinion that radium is somewhat superior to the roentgen ray for these small, superficial epitheliomas, providing the beta-rays are utilized and that all crusts, scales and discharge are removed before the application is made. The author has not detected any difference in efficacy between gamma-rays of radium and the roentgen ray. The radium applications have been intensive, one exposure being sufficient to produce a first or second degree reaction.

TECHNIC OF APPLYING THE RADIUM PLAQUE

It is, of course, a very simple matter to treat a small lesion with a radium plaque. If the growth is larger than the applicator, the entire lesion is covered by dividing it into areas and the plaque applied to each area, care being taken to avoid overlapping. If the applicator is considerably larger than the lesion, the latter is surrounded with lead foil as when applying the roentgen ray. The dose will depend on the amount of radium element contained in the applicator. While the author prefers intensive treatments, the erythema dose may be divided into fraction. If, for instance, it requires 15 minutes with the unfiltered applicator in contact with the skin to produce a marked erythema, five fractional doses of three minutes each could be given, although it will probably require a total of from 20 to 25 minutes fractionally administered to obtain the same degree of reaction as affected by the single application of 15 minutes. The difference in time of exposure between filtered and unfiltered radium, especially if a lead filter is employed, is enormous, and unless one has a very large amount of the element the time required (several hours) for an intensive dose is a positive nuisance, especially when one considers that the results of such treatment are no better than those obtained with the roentgen ray, which only requires a few minutes for the administration of an intensive dose.

CASES IN WHICH RADIUM TREATMENT IS PREFERRED

There are instances in which radium is of especial service. In cases in which the lesion is situated on the eyelid, the beta-rays may be employed and the eye itself need not be protected excepting by the lead foil which surrounds the lesion. The eye will not be injured by the small dose of gamma-rays and the more penetrating beta-rays that pass through the lesion and reach the eye unless several applications are necessary in which case it is preferable to protect the eyes as when using the roentgen ray. If the lesion is situated on the nose a radium plaque can be applied to the lesion and a tube of the element placed in the nose for the purpose of cross-firing.

When the lesion involves the nasal alæ and extends into the nose, or when situated at the commissures of the mouth and involving the buccal mucosa, or when located at the margin of the lids with involvement of the conjunctiva, radium is often easier to apply and may prove more efficacious

than the roentgen ray. Conversely, radium is more difficult to apply to the inner canthus than is the roentgen ray on account of the irregularly concave surface. When treating moist surfaces the unfiltered plaque is usually protected by a single layer of gutta-percha tissue, very thin rubber, or oiled silk.

In order to avoid the very superficial beta-rays a very thin filter ($^1/_{10}$ mm. aluminum) is advisable, even for superficial lesions. It should be borne in mind that radium, if improperly applied, will effect all of the sequelæ produced by the roentgen ray, namely, second and third degree "burns," atrophy, telangiectasia, peratoses, and similar conditions.

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ROENTGEN RAY INDICATIONS FOR TOOTH EXTRACTION

THE MEDICAL ROENTGENOLOGIST AS THE IMPARTIAL CONSULTANT FOR THE PHYSICIAN, THE DENTIST AND THE PATIENT

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THE roentgenogram shows when the condition about the infected tooth is such that it menaces the health of the patient. The trained roentgenologist can diagnose the condition which indicates extraction. This he should prescribe, as at present no other method can be guaranteed to remove the focus of infection.

ORAL FOCI OF INFECTION THE CAUSE OF SYSTEMIC DISEASE

"The idea that mouth infections often cause serious secondary effects has in recent years become definitely crystallized in the minds of physicians, dentists. and laymen." It is with this fundamental principle that Arthur D. Black[1] begins his discussion of "Roentgenographic and Microscopic Studies of Tissues Involved in Chronic Mouth Infection." And it is well to remember that it is this proven condition that necessitates the co-operation of the physician and dentist. Dr. Black continues: "Clinical observation has been supported by careful laboratory investigations. It is now generally recognized that a chronic suppurating focus may lead to any one of a considerable group of diseases, most of which are insidious in their development and extremely chronic in their progress. . . . It would seem desirable to establish the element of danger to health which these infections represent. . . . It is certainly illogical to conclude that a particular systemic effect is due to a mouth focus unless all other sources have been eliminated. Without question, in many cases, several sources are acting simultaneously."

The point is that no matter how many other sources of infection there may be, the fact still remains that if foci of infection exist in the mouth they should be removed to clarify the situation.

DISAGREEMENT AMONG DENTISTS AS TO PRACTICE

Until the advent of the roentgenographic diagnosis, which came like a day of judgment upon the incompetent and incapable, the principle of dentistry was the preservation of the tooth at no matter what cost. When modern medicine reached the conclusion that septic conditions exerted a greater influence on the health than had been previously thought possible, and supported this conclusion with pathological and roentgenographic examinations, dental practice had to be revised. Dental practice is still being revised, for the facts were too strong to be controverted.

For example: In 1911, Sir William Hunter[2] stated the case thus:

"The worst cases of anemia, gastritis, colitis, of all kinds and degrees, of obscure fever of unknown origin, of purpura, of nervous disturbances of all kinds ranging from mental depression up to actual lesions of the cord, of chronic rheumatic affections, of kidney disease, are those which owe their origin to, or are gravely complicated by the oral sepsis produced in private patients by these gold traps of sepsis."

In July, 1918, *Dental Cosmos* reprinted this article with editorial comment, which shows what an effect the weighing of the facts had had in the seven years elapsing between the original speech and their comment. They deprecate "the enthusiasm" which led to "advocating, even urging the *indiscriminate* extraction of teeth" and "the acceptation of oral sepsis and faulty

[1] BLACK, ARTHUR D., *J. Am. M. Assn.*, August, 1917.

[2] HUNTER, SIR WILLIAM, *Dental Cosmos*, July, 1918.

* Presented at the Nineteenth Annual Meeting of the American Roentgen Ray Society, Chattanooga, Tenn., September, 1918.

dentistry as the possible cause of many puzzling conditions met with by the medical practitioner." But, after this excursion, *Dental Cosmos* concludes fairly and justly: "While some of the statements made by Dr. Hunter are *perhaps rather excessive*, they are on the whole, we believe, in accordance with the general facts of the situation. Though the truth is frequently unpleasant, it is never unwholesome, and if the stimulus of Dr. Hunter's pointed criticism shall arouse the organized dental profession to renewed activity in the effort to eradicate the ignorant and incompetent practice of dentistry, he will have conferred a boon upon humanity."

PRESENT METHODS NOT ASEPTIC

When the roentgen ray was first introduced, it showed abscesses at the roots of teeth which had been pronounced aseptically filled and which were, clinically considered, sound.

F. B. Moorehead says: "The overwhelming majority of chronic abscesses being associated with previously treated root canals serves to emphasize the importance of root-canal technique. Faulty root-canal technique, the careless use of arsenic as a devitalizing agent, and irritating drugs in the treatment of root canals are strong predisposing factors of chronic alveolar abscess." Arthur Black and Clarence J. Grieves also report the septic condition of root-filled teeth.

The search began for methods which would render the tooth to be treated completely aseptic. As yet *no method* has been devised which will be efficacious in every instance. Concerning electrolytic medication Samuel E. Pond and Weston A. Price report: "It has been assumed by those using 'Electrolytic Medication' (a) that electrolytes or ions, (b) that electric current and (c) that the electrically precipitated elements, killed bacteria. We have (using the electrolytes recommended by practitioners) found no evidence to support such a position. It seems there is no such *direct* action leading to disinfection under present practice. If there is a beneficial action or disinfection, it must be indirect."

Clarence J. Grieves[3] admits: "The sterilization of dentin and cementum without destruction of adjacent tissues is the profession's greatest problem, which when solved, will save countless teeth, but it has not been accomplished as yet. . . . It may be said, with one or two exceptions, all the methods, including the latest ionic medication, are much too drastic and objectionable: to be effectively germicidal, the electric potential and dissociation, or coagulating and oxidizing elements in each, must be so high as to produce a secondary surrounding tissue necrosis, which usually becomes reinfected; a destruction of the reparative cells, but not the pathogenic element. . . . When dentin is absolutely saturated with bacteria, from long pulpal or salivary exposure or is associated with granulating or liquefying periapical invasion, its complete sterilization is questionable. After the application of all sorts of germicides, the pulp canal may be proven sterile, but if after careful extracting technique, preventing contamination, a horizontal section of the root be split, as in apiectomy, and chippings be taken from the outer areas about the granular layer, positive cultures are almost certain."

OFTEN EXTRACTION IS ONLY METHOD

Dental research is still working to find a completely aseptic method that will save the tooth and at the same time remove the focus of infection. But under present conditions, the weight of medical and dental practice is in favor of extraction if this is necessary to destroy the focus of infection.

Grieves concludes: "The writer does not agree with the oral surgeon who condemns every *pulpless* tooth; on the contrary, he knows it is possible, if the patient will present himself in time, to remove the pulp and aseptically fill *vital* root apices,

[3] GRIEVES, CLARENCE J., *J. Nat. Dent. Assn.*, August, 1918.

of a large percentage of such teeth, with no postoperative periapical infection, a fact which can be established radiographically and by cultural tests, *but he does not believe that an infected or abscessed root apex should be retained for a minute nor would he spend that time on one, unless attempting apiectomy.*"

Josef Novitzky[4] goes even further and demands more than extraction for certain conditions, even the removal of parts surrounding the diseased tooth by surgical dissection.

F. B. Moorehead[5] concludes: "Regardless of whatever form of treatment may be employed, the removal of infection is imperative in all cases, whether the patient at the time may be well or ill. . . . Where the health, comfort and usefulness of a patient are to be weighed over against a tooth, or even against all the teeth, the greater interests of the patient must be preserved."

Moorehead makes a strong point for extraction in this comment: "An interesting feature of our study of the frequency of chronic mouth infections was the discovery that the poorer classes had relatively fewer chronic abscesses than the middle and well-to-do people . . . the poor people usually have aching teeth treated by early extraction."

Arthur D. Black concludes: "The chronic focus is therefore properly considered a menace to the health, and its removal is demanded. . . . These suppurating detachments of the peridental membrane are in practically all cases permanent detachments, whether the detachment is at the side of the root or the apex. The area of bone destroyed about the apex of a root is not so important as the extent of the destruction of the peridental membrane. There is no hope of reattachment of the surrounding tissue to the root, and if such teeth are permitted to remain in the mouth—excepting those which are operated on by re-section—it should be with the definite understanding that they necessarily continue as a menace to the health of the individual and that the use of such teeth in mastication overbalances this menace to the health. . . . In such cases we are using our best judgment as to the patient's general physical condition and his resistance. We must do this with the thought ever in mind that nephritis, endocarditis, cholocystitis and other secondary effects are so insidious in their onset that the condition is likely to be serious and the patient even beyond the possibility of recovery before it is discovered by the physician."

In discussion, Dr. Black was even more emphatic: "There is a set of roentgenograms of the mouth of a patient who was under the care of a so-called pyorrhea specialist. The roentgenograms show that the alveolar process has been destroyed nearly to the ends of the roots of the upper bicuspids and molars, and these teeth are apparently being *held in place* by orthodontia appliances while they are scaled and treated. This case illustrates what I meant when I said the practice of dentistry needs to be revolutionized. Here is a mouth in which it is evident to anyone who has studied the problem of focal infections that the teeth should be extracted. The dental profession must recognize that such foci are a menace to health; then it will not be difficult to get action. The more I study these conditions, the more I am convinced that more teeth must be extracted."

NECESSITY OF DIAGNOSIS BY TRAINED ROENTGENOLOGIST

After all is said the clinical findings are inconclusive. Only the roentgenogram will define the condition about the tooth so that extraction or nonextraction may be prescribed rationally. "Good roentgenograms," Grieves says, "are rarely misleading, and it is the writer's experience that postoperative results are always more pronounced than the *x*-rays would indicate. . . . Just as soon as it can be

[4] Novitzky, *J. Nat. Dent. Assn.*, June, 1918.
[5] Moorehead, *J. Am. M. Assn.*, September, 1916.

roentgenographically demonstrated that diseased periapical regions exist as described, medication should stop and surgery begin."

J. M. Walls[7] says definitely: "It is not alone in mechanical lines that new ideas have changed the course of thought and tendencies of procedure. Perhaps nothing has arisen in the history of dentistry that has so awakened the minds of the profession as the discovery by roentgenography of periodontal infection where teeth and the surrounding tissue were by previous measures judged healthy."

Alfred R. Starr's[8] opinion is: "The roentgen rays have probably done more for dentistry than any other modern discovery. Many hidden dangers have been brought to light and many teeth, which before the application of this method would have been doomed to extraction, can now be saved. Much remains to be learned in regard to the use of this method so far as the interpretation of the pictures is concerned."

J. Melville Thompson[9] says: "As to the value of the roentgen rays in dentistry, I think at the present time dentists are scared stiff by the reports the medical men are making of their work."

F. B. Moorehead's opinion is: "Both in diagnosis and in determining the extent of tissues lost, the roentgen rays are paramount. . . ."

Thomas B. Wade:[10] "The *x*-ray diagnosis of root-canal work, fractures and foreign bodies is final. . . . The *x*-rays do not reveal to us whether there is pus or granulation tissue present."

Frank Billings[11] says: "Many roentgenographic films of the jaws have been made from patients in our clinic at Rush Medical College and at the Presbyterian Hospital, suffering from chronic arthritis. One film shows an alveolar abscess in a patient with Hodgkin's disease. These films as a means of recognition of alveolar infection are not new to members of this section, but this method of examination of alveolar disease is not sufficiently utilized by dentists and physicians generally. It should be used, for by no other method may one know the exact condition of the alveoli and roots of the teeth."

Speaking of pyorrhea, Hollis E. Potter[12] concludes: "A general survey of the denture by a series of dental films is an important adjunct to the examination of a pyorrhea case. It is often a short cut to a diagnosis and is less disagreeable than an instrumental examination, but should supplement rather than displace other diagnostic methods. The most important diagnostic points are observable in the region of the intimate bony vestments of the roots and are obtainable only from the most critical roentgenograms."

The fact that the roentgenogram is necessary to, and often decisive in, diagnosis emphasizes the importance of its being made by a trained roentgenologist.

RELATION OF THE ROENTGENOLOGIST, THE DENTIST, AND THE PATIENT

The roentgenologist will give an impartial and disinterested diagnosis and recommendation. The nub of the matter is to establish a practice that satisfies the courage of one's convictions. It is now generally accepted among the men quoted that once disease about the apex of a tooth becomes a focus of infection, it is always a focus unless it is surgically removed. No root canal treatment is established, none is even locally accepted. Although many theories are plead, and courageously and stoutly demonstrated, no one will guarantee anyone else's plan. A few will go so far as to guarantee, tacitly at least, their own, by offering it to their patients.

Surgically, there is only one solution: removal of the disease. In opposition there is practical dentistry which has to meet the following demands:

1. Freedom from the menace of the focus of infection.

[7] WALLS, *J. Nat. Dent. Assn.*, August, 1918.
[8] STARR, *J. Nat. Dent. Assn.*, August, 1918.
[9] THOMPSON, *J. Nat. Dent. Assn.*, August, 1918.
[10] WADE, *Dental Cosmos*, August, 1918.
[11] BILLINGS, *J. Am. M. Assn.*, December, 1914.
[12] POTTER, *J. Am. M. Assn.*, February, 1917.

2. Preservation and conservation of the teeth; if the teeth are lost, there is the problem of replacement, whether by pivots or crowns or by fixed or removable bridges or by plates; these are purely dental problems.

3. The patient's desires; whether his æsthetic inclinations and idiosyncrasies will accept crowns or bridges or plates; whether his fear of advancing age is quieted by removal of the focus of infection or shocked by the removal of a tooth, and consequent artificial replacement. Many patients who do not or will not understand, prefer any putrid contraption that belongs to their chosen dentist, to a clean mouth. At the present time the dentist has more consideration for the patient's whims than the medical man has, for the latter is determined only to remove the source of infection or disease.

The roentgenologist is dealing with a fairly exact method of diagnosis and he is only concerned in arriving at the facts and giving the proper aid and information. He is free from—

1. Any pride of reputation in the previous dental work.

2. Any financial interest in future dental work.

3. He is trained to interpret and value the roentgen rays evidence, and so is in a position to appreciate the kind of procedure which will cure the disease whether this may be treatment or root amputation or extraction.

Mistakes in interpretation are always possible, but it is to be presumed he is experienced and aware of the ordinary sources of error. Dentists should be aware of the limitations of the roentgen ray examination and use every additional clinical method available. Roentgen rays are of greatest value in diagnosis. Obviously there is no other one method of equal value. If there was, it would be used and well known.

No method is equal to the graphic method of charting roentgen ray findings. (See illustration.) In this way the roentgenologist puts himself absolutely on record so that his findings can be checked up. If the dentist disagrees, he can consult by telephone as duplicate sets of films and chart are kept. As a matter of fact, rarely does a dentist do this. He is apparently satisfied. But if he intelligently differs, both he and the roentgenologist benefit by the discussion.

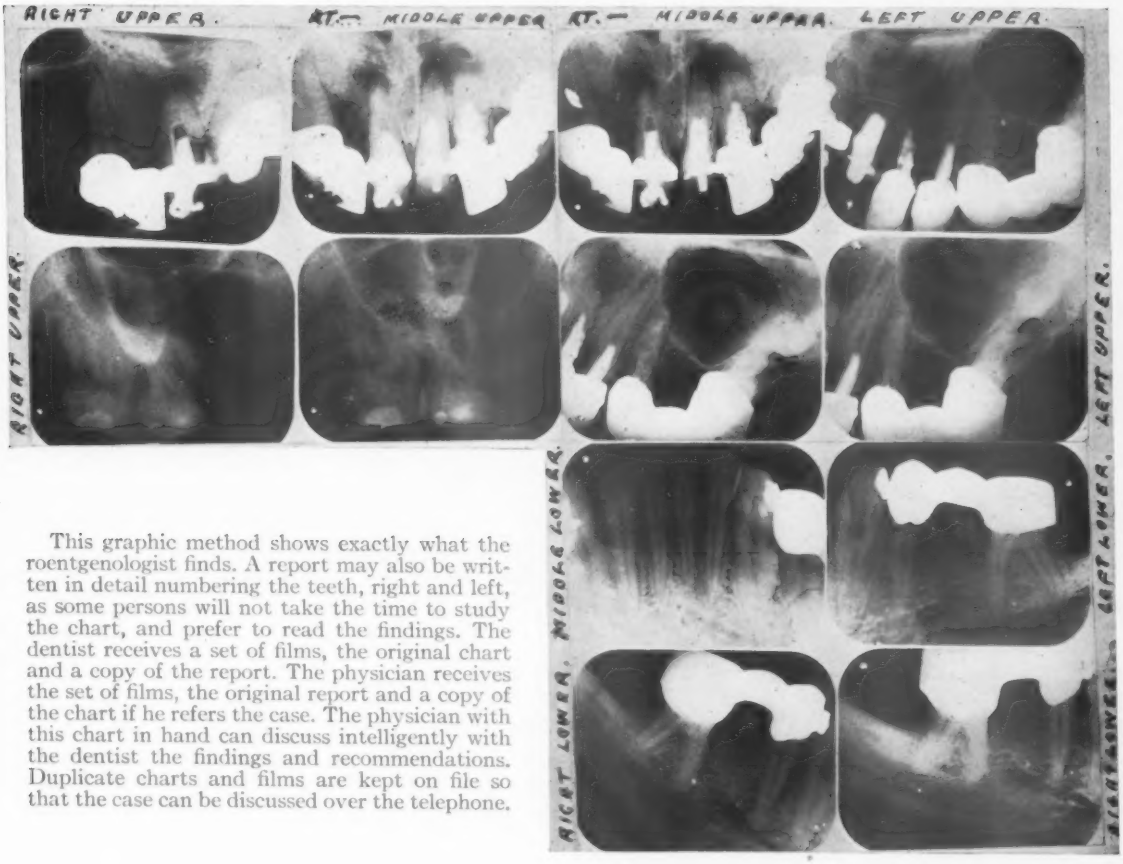
A popular use of the roentgen ray machine by dentists for this branch of their work is a great mistake for the following reasons:

1. Few dentists can take time to perfect themselves technically so as to get clear enough roentgenograms. There is difficulty in the adjustment of the tube and in developing and drying the film, which determine the usefulness of the film. A poor film is often useless. Few dentists will be able to obtain trained assistants for this work. Roentgen ray machines should not be used without proper protection to the operator, nor should films be held in the mouth, as it is said one prominent dentist did up to only one year ago.

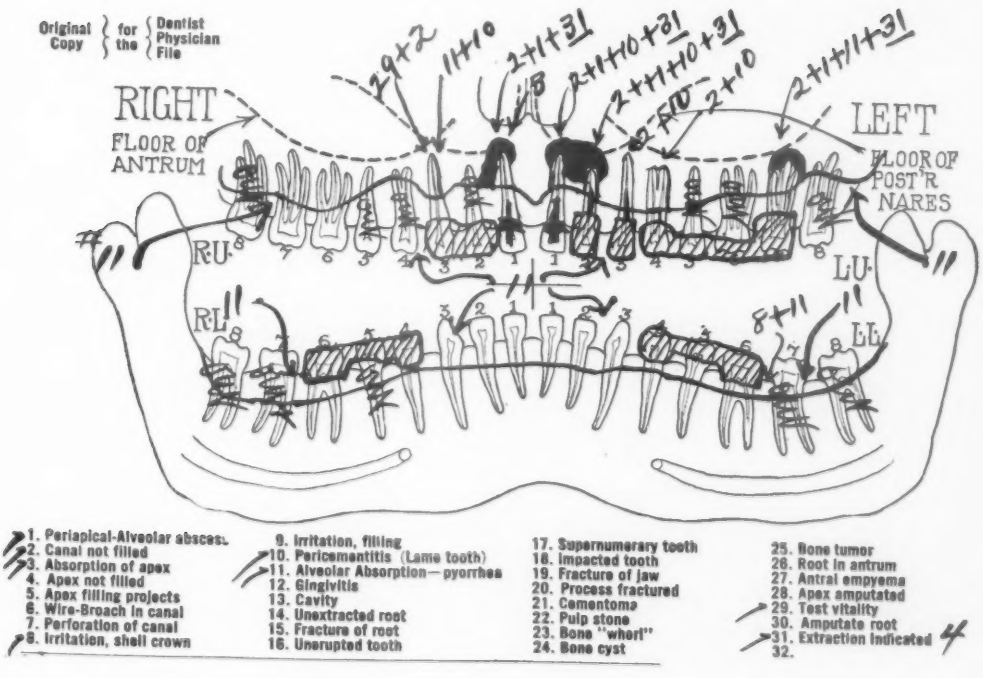
Granted even that he can produce good technical work, and that the dentist is able to give time and attention to get good technical work, the matter of interpretation is to be considered. This comes with experience as much as with anything else. The mere fact that a thing is a picture does not change the difference between the amateur and the expert. There are many variations of the same thing. It is experience and familiarity which give a proper sense of values . . . an entirely different matter from being able to recognize something pointed out.

2. Another thing of no less importance is the division and sharing of responsibility. The patient has two trained men considering the question instead of one. Presumably he pays for the extra service and is entitled to the best.

3. The dentist should consider the cost of installing a roentgen ray machine, for the cost may be equal to the total cost of all his other equipment. A roentgen ray machine is not like a compressed-air blower.



This graphic method shows exactly what the roentgenologist finds. A report may also be written in detail numbering the teeth, right and left, as some persons will not take the time to study the chart, and prefer to read the findings. The dentist receives a set of films, the original chart and a copy of the report. The physician receives the set of films, the original report and a copy of the chart if he refers the case. The physician with this chart in hand can discuss intelligently with the dentist the findings and recommendations. Duplicate charts and films are kept on file so that the case can be discussed over the telephone.



And he would use this machine, comparatively speaking, less than any other piece of equipment. As a matter of good business, it does not pay the dentist to lay out capital for an expensive machine, which is then kept idle most of the time; it would not pay him to study a specialty which he would use very seldom—so seldom that he could not become expert in it—when he can have the services of a specialist for roentgen ray work, and the advantage of expert diagnosis to compare with his own.

Roentgenology is a specialty not to be lightly valued by the dentist. He should occupy his time with his dental work, and his roentgen ray work should be done by a competent roentgenologist.

In passing, one should mention the legal possibilities when this subject of focal dental infection becomes generally known to the laity, as it no doubt will be soon by popular articles of more or less merit. Law suits have been and no doubt will be instituted, as there is no accepted practice and standardization, eminent authorities disagreeing on almost every vital particular.

REPORTS

Proper procedure in reporting a case should protect the interests of everyone concerned and at the same time give the patient every advantage of service rendered. For example, if a physician sends me a patient, I send direct to him a set of films for the dentist, and a copy of my chart indicating my diagnosis for the physician's files, to go with the patient's other history and laboratory report. I send the original of the chart with the diagnosis indicated to the dentist. The patient has no opportunity to study the report before the dentist receives it. This is quite fair to the dentist. But the dentist is not a fixed quantity, as people change dentists from time to time, and probably more under these circumstances than ordinarily.

Now, what are the patient's rights? He has been going around to three professional men and, if he is intelligent, he will observe there is at best a spirit of restrained co-operation, and perhaps no very frank conclusion divulged by anyone. If a patient's health is at stake, should he not be aware of every suspicious tooth in his head? He may have to change dentists due to change of residence, death of dentist, or what not. He may need periodical roentgen ray examination. I believe that a *complete* solution of the problem is not attained until the patient has a copy of the chart and letter from the roentgenologist, indicating which teeth show sufficient disease to warrant extraction. Then if the patient wants to take the responsibility of retaining the tooth, the dentist is in a safe position. He is not running counter to medical opinion, nor does he benefit by the patient's inclinations or fancies to do a lot of expensive treatment or mechanical work which may eventually be more of a curse than a blessing. The dental profession has been all through this already; the fair-minded ones admit their mistakes but many still pursue their accustomed ways or with only slight changes.

More frankness and co-operation will wear out the routine grooves so that this vital matter can be handled entirely in a constructive manner. Everything in medicine or dentistry points to a *united* practice.

CERTAIN TEETH TO EXTRACT IN PERIAPICAL ABSCESSES

In an apical abscess, the question arises whether the extent of the danger may be estimated by the size of the abscess, and if not the size, then what factor may determine the danger. The size is not an indication of the extent of the danger present.

However, although the size has no bearing on the danger, it might seem to have a bearing on the possibility and method of treatment; and the smaller the abscess is, the easier it would seem to treat, if it is decided to treat the tooth.

If the pericementum is not gone, and the apex is not stripped, natural repair

might take place even though no treatment at all is given. The correct procedure would be to empty the canal aseptically, to try to sterilize it, and to refill it aseptically. But it is never possible to be sure that the process is completely aseptic.

If in the course of this procedure it has not been re-infected, the natural processes of repair will repair the periapical disease.

But an abscess of any considerable size or any definite area of disease, means the tissues are in the presence of infection and the only satisfactory treatment is surgical treatment, e.g. root amputation. This applies to any loss of bone more than the width of a line, presuming that a simple pericementitis may recover through restoration of itself, leaving fibrous tissue to form the union between the alveolar process and the tooth.

But if the tooth is a dead tooth, it is said there can be no repair from the canal side, as the nutrition of the tooth circulates between the pericementum outside and the lymph and blood supply inside. It is obvious that if either side disappears through disease, nutrition is impaired if not lost and the tooth becomes at best an aseptic foreign body. Now if the dental tubules are infected, as established by Price and others, the foreign body is septic and so must be extracted or amputated.

WHEN TO EXTRACT IN PYORRHEA

Pyorrhea or peridontoclasia is a general name applied to any destructive disease of the alveolar process whether there is macroscopic pus or not.

If the disease extends from the margin of any considerable alveolar absorption on one side around the apex to the other side of the tooth, as shown by the b'ack line indicating pericementitis, such a tooth should be extracted for it is probably worse than the roentgen rays show.

But if the tooth shows consideralbe alveolar absorption yet is still sound on its apical one-third, such a tooth may be saved by intelligent surgical treatment for pyorrhea and should be left. This surgical treatment is now a specialty in dentistry for the peridontist or pyorrhea specialist. It is only a question of time: if disease is *not arrested*, the tooth will be lost. Much loosened teeth should always be extracted if treatment is not effective.

In pyorrhea the roentgen ray is of equal value as in apical abscess for showing peridontoclasia or absorption of bone of the alveolar process by disease. A roentgenological survey of the teeth will show an extent of disease that is often impossible to diagnose by clinical examination and will be a guide for instrumentation of the pockets and correction of shell crown and filling irritation so often the cause of the trouble.

Malocclusion as a cause of pyorrhea is purely a problem for the dentist.

Nor does the film show only the disease between the teeth, for proper films will show the pockets in the gingival and buccal margins.

CURETTING

It would seem, in the light of one's experience, that after the granuloma or abscess is broken up by the extraction repair would take place without curetting the remaining wall of the abscess.

In fact, the abscess being already walled off, it would seem to be bad practice to carry infection deeper, and while there is a tendency to advocate curetting, the practice might be abandoned for the old, tried, common method of extracting the tooth only. The writer has never seen in the film any evidence of disease in the bone where complete healing of the gum had taken place. This in itself would be sufficient evidence that there was no infection below unless some other tooth was at fault.

There are many dangers to be met in curetting: in the upper jaw the adjacent nerves may be injured, the antrum may be entered, and disease may be extended by breaking through the walled-off area.

In the lower jaw, adjacent nerves may be injured, the inferior dental canal may

be entered, and extension may be carried through the broken-down, walled-off area.

The extracted tooth offers free drainage and from time immemorial this practice has been sufficient. Why assume the responsibility of introducing this radical operative interference?

CONCLUSION

Dr. Harold S. Vaughn's conclusions on this subject offer a good summary of proper practice: "I consider the roentgen ray indications a fairly definite working basis for extractions and root amputations though nearly all cases should be checked up by a careful examination of the mouth and teeth as occasionally a non-pathological rarefied area or a foramen may appear in the film like a definite focus of infection; or conversely, we sometimes see black infected teeth that show little periapical change due to the fact that they drain through a thin bony layer to the surface, and thus we do not get the destruction of bone as in the case of walled-in infections. The diagnosis should be based primarily on the roentgen ray findings tempered by the clinical experience gained by the study of roentgen rays of other cases where the teeth and infected tissues had subsequently been removed giving a chance for comparison.

"My own observation leads me to believe that only a small number of teeth showing periapical infections can be completely cleared up by canal sterilization and filling; and they are the ones in which the tissue in this area is a semi-organized granuloma without destruction of the pericementum around the apex or a breaking down and liquefaction of the contents.

"Another class of cases can be cleared up by amputation after sterilization and complete filling of the root canals. These are the ones that have a destruction of the apical pericementum, erosion of the root apex surrounded by an organized lining membrane with liquid contents,—assuming that the destruction is not too great.—Amputation is not advisable for posterior teeth except in selected cases.

"Extraction followed by surgical removal of the infected area is indicated in the vast majority of teeth showing periapical infection and the routine conservative methods at present fall far short of the requirements in the removal of foci.

"I believe that it is almost impossible to carry out successful root canal treatment in the army even where they would be indicated in civil practice as the work is done under unfavorable conditions except possibly in some base hospitals."

GAS GANGRENE OF THE LEG DUE TO B. WELCHII

REPORT OF A CASE DIAGNOSED ROENTGENOLOGICALLY

BY FRED A. SPRAGUE *

Captain, M. C., U. S. A.

CAMP ZACHARY TAYLOR, KY.

FRED ———, white, civilian, age 15 years, a native of Elizabethtown, Ky., was admitted to the base hospital, Camp Zachary Taylor, Ky., on the evening of April 8, 1918.

Previous History.—Negative.

Present Illness and Cause of Admission.—Patient was watching a machine gun, April 6, 1918, while standing on the Court House green at Elizabethtown. The gun was accidentally discharged, the patient receiving the ball through the left knee joint. The wound was dressed and cared for by a local physician until April 8, when the patient was admitted to the base hospital.

FIG. 1. SERIES I. MADE 8.30 A.M., APRIL 9, 1918.

A physical examination at this time showed a gunshot wound in the left knee, the wound of entrance being just below the patella, that of exit being four inches below this on the back of the leg. There was a foul discharge from the wound and the leg was swollen. The foot was cold, and discolored up to the ankle. The temperature was 102, pulse 140, and respiration 32.

On the following day, April 9, the discoloration extended to within four inches of the knee. B. Welchii was positive in both the smear and culture of discharge from the wound. An injection was given of 3.5 c.c. B. Welchii antitoxin and the extremity was amputated by guillotine operation at upper third of the thigh on April 9 at 2.30 P.M.

On April 10 the temperature dropped to 99, the pulse to 110, and the respiration to 20.

Postoperative History.—The stump was treated with Dakin's solution, but a second amputation had to be performed to secure a proper stump. After that, convalescence was uninterrupted and the patient is in good condition at the present writing.

The first roentgenogram, Series 1, was made at 8.30 A.M., April 9, about seventy-two hours after the accident. It shows a very considerable infiltration of gas in the tissues, involving the lower third of the thigh and all of the leg and foot up to the metatarsal bones. The accumulation of gas is most marked posterior to the upper third of the fibula where it evidently dis-

* Authority to publish granted by Board of Publication, Surgeon General's Office, Washington, D. C.

sected its way down from the knee joint. It is plainly visible in the tissues beneath the plantar fascia as shown on the original plates, but this part, unfortunately, was not printed. The soft tissues of the knee

FIG. 2. SERIES II. MADE 1.30 P.M., APRIL 9, 1918.

are shown somewhat swollen, and those just below the patella much distended with gas which almost obliterates the tissue outline. A diagnosis of gas infection, confirmed later by the surgeon and the pathologist, was made from this plate.

Series 2 was made at 1.30 P.M., April 9, about five hours after Series 1. In these plates the progress of the infection is quite evident. The thigh is involved up to the upper third, and the accumulation of gas in the soft tissue obscures the structure of the femur.

Series 3 was made twenty-four hours after amputation at 3.30 P.M., April 10. The organism continued to proliferate after separation of the part and the resulting gas so distended the soft tissue as to make their structure very dimly visible.

Pathologist's Report.—Left leg and lower part of thigh: the leg from the knee downward shows greenish discoloration and is very malodorous, in spite of the fact that it has been kept in a four per cent solution of formaldehyd for the past five days.

The résumé of the finding is as follows:

1. The tissues of the thigh showed no gangrene nor inflammatory changes, appearing healthy in every way.

2. The tissues of the leg showed marked inflammatory changes, having a parboiled appearance.

3. The knee joint was distended with a dark, somewhat frothy, bloody fluid. Smears from this fluid show fairly well-

FIG. 3. SERIES II. MADE 1.30 P.M., APRIL 9, 1918.

preserved red blood cells, and a large number of Welch bacilli.

4. The cartilages of the knee joint and the bony articulations were normal in every way.

5. The immediate neighborhood of the gunshot wound was converted into a greenish-black gangrenous mass.

6. The sciatic nerve in this region was of a greenish-black color and softer than normal. About 10 cm. below the region of the gunshot wound it was of normal color and firm consistency.

7. The femoral artery was uninjured and free from any thrombus or embolus.

8. The femoral vein was ruptured in the region of the gunshot wound. This injury may have been caused by the post mortem operator.

9. In the sheath of the large vessels, for about 10 cm. upward, and for about twice this distance downward, a slightly frothy, dark red, bloody fluid existed. From the appearance it might be judged that, during life, this material caused compression of the vessels.

10. To a less extent similar bloody material existed in the muscle sheaths down the leg.

11. Ten days after amputation, although the leg had been kept in a four per cent solution of formaldehyd, smears still showed B. Welchii, thus proving the viability of the organisms.

FIG. 4. SERIES III. MADE 3.30 P.M., APRIL 10, 1918.

FIG. 5. SERIES III. MADE 3.30 P.M., APRIL 10, 1918.

Summary.—This case demonstrates well the certainty with which a diagnosis of gas gangrene can be made by the roentgen ray. It also shows the extentto which the infection progressed within six hours. It is my opinion, in which Colonel Welch, of the Surgeon General's Office, concurs, that within twelve hours after the entrance of a foreign body, the gas infection resulting therefrom can be recognized. It will be confirmed within six hours afterwards by another plate which will show considerable progress. Colonel Welch states that Colonel Bull reports that the result of infection from gas bacillus begins within twelve hours, and extends considerably within six hours thereafter. This six-hour progression can be demonstrated by the roentgen ray plate. It is therefore advisable, and is a definite rule of the hospital, that each case of injury with a foreign body in the tissue be followed up with six-hour plates until gas infection can be certainly excluded.

I am under obligation to the Surgical and Pathological Departments of the Camp Zachary Taylor Base Hospital for the accompanying data.

MECHANICS OF THE STOMACH AFTER GASTRO-ENTEROSTOMY

BY JOHN T. MURPHY, M.D.

TOLEDO, OHIO

THE following are a series of observations upon 25 cases in which gastro-enterostomy was performed for ulcer of the stomach or duodenum. The cases were taken from our records and no effort at selection was attempted. The object of the examination was to help the surgeon in the proper location and size of the gastro-enterostomy opening.

In doing this several main things were kept in mind. What becomes of the new opening in a stomach after gastro-enterostomy? Does it functionate in the presence of a patulous pylorus? Is it always necessary to occlude the pylorus after gastro-enterostomy is performed? Is gastro-enterostomy a drainage operation? Do such artificial occlusions remain permanently closed? Upon all of these questions there is as yet little unity.

All of the cases in this series were cases of ulcer of the stomach or duodenum, and in every case a posterior gastro-enterostomy was performed. The methods employed were the same as are used in an ordinary gastro-intestinal case. A pint to a quart of buttermilk, in which were mixed four ounces of mucilage of acacia and from two to four ounces of barium sulphate, was given the patient in the upright posture. Four hours were allowed as the normal time for the emptying of the stomach of this meal. The vertical fluoroscope was used in the preliminary examination to determine the position of the opening, the shape, size and position of the stomach. In the examination of the pylorus and of the duodenum, if shown, the right lateral prone position was used. The ages of the patients examined were from 25 to 60 years. The length of time since the operation was as follows:

Less than six months	6
Over six months but less than one year	6
Under a year and a half but over one year	6
More than two years	3
More than four years	1
More than six years	1
Date unknown	2

In many of these cases no difference in the filling of the stomach was noted. In others the rapidity with which the food left the stomach prevented it from filling

except in part. In several cases, the entire organ filled just as in the normal, including the pylorus, and then the opening began to functionate and allowed the food to pass rapidly into the small bowel. In these cases, even though the pylorus was patent, only a very small amount passed out in the normal way in the upright position. In a certain number of these cases the food left the stomach rapidly, until only a small amount remained along the greater curvature of the stomach, with a corresponding amount in a loop of the jejunum. This remained for some time, but in only one case did this stasis persist long enough for it to be of pathological significance. In this case, a posterior gastro-enterostomy, number 21 of the list, the anastomosis was made parallel to and high up on the greater curvature. The pylorus was sutured and remained closed. The food ran out of the new opening very rapidly until its level was reached, then it emptied slowly, leaving a residue at 24 hours. This case had very severe symptoms, pain, feeling of heaviness, gas eructations and vomiting and the patient was very miserable generally. In only four of the cases of this series were the patients not uniformly well. In all but one of these four, the reason for the recurrence was found at the fluoroscopic examination. In case number 20 the gastro-enterostomy was functionating perfectly, emptying the stomach in two and one-half hours, with nothing but the slightest delay in the jejunum to account for the symptoms. The stomach was spastic which suggested that possibly the ulcer had never healed. A positive Wassermann reaction with an amelioration of the symptoms following anti-syphilitic treatment established a diagnosis of gastric crisis. This has been substantiated by the progress of the spinal disease since the examination. In number 23, because of a complete recurrence of pain and distress 18 months after the gastro-enterostomy, the patient applied for re-examination. An irregularity of the pylorus suggested carcinoma although the new opening was functionating well. Re-operation revealed a carcinoma of the pylorus engrafted upon the ulcer site. This caused the death of the patient. Case number 21 had a recurrence of pain after meals about six months after the operation. Upon examination stasis was found to occur posterior to the stomach and, after careful study of the barium movement, we believe that an extra loop of jejunum had been included in the operation, causing a stasis at this point with distention of the bowel which continued some time after the stomach was empty. No subsequent operation has been performed so we have no operative confirmation.

We have deduced from the above data:

That patients having gastro-enterostomy operations properly performed are uniformly well.

That a patent pylorus does not interfere with the function of a properly placed gastro-enterostomy opening.

That the opening must be of sufficient size placed at the lowest point and almost directly below the lesser curvature of the stomach.

That openings so made remain open permanently.

That it is not a necessity but a good surgical procedure to occlude the pylorus, thereby causing the stomach to empty, at least temporarily, by the gastro-enterostomy opening.

That gastro-enterostomy is a drainage operation.

That in no case have we ever been able to demonstrate serious distention of the loop of a small bowel near the opening into the stomach.

That regurgitation of food back into the stomach does not seem to make any difference in the results of the operation.

That ulcer diet should be used after the operation. That liquid food, by preference cool liquids, leave the stomach with the least peristalsis. That all gastro-enterostomy patients should eat frequently and a less quantity of food at each meal.

TABLE OF CASES

No.	Age	Sex	Time since Operation	Treatment of Pylorus	Peristalsis	Emptying Time	Stasis in Small Bowel	Type of Stomach
1	55	M	9 months	Not closed	None	4 hours	None	Normal
2	42	M	5 months	Closed	None	3 hours	Slight, near stomach all clear in 2 hours	Hypertonic
3	38	M	8 months	Excision of pylorus	Normal	4 hours	None	Hypotonic
4	46	M	21 months	Closed	None	1½ hours	None	Normal
5	35	F	17 months	Not closed	None	½ hour	None	Normal
6	55	M	11 months	Closed	None	4 hours	None	Hypotonic
7	23	M	2 months	Partial closure	Deep	2 hours	None	Hypertonic
8	50	F	3 months	Partial closure	None	1½ hours	None	Hypotonic
9	45	F	11 months	Not closed	None	5 minutes	None	Hypertonic hour glass spasm relaxed at 2 hour examination
10	36	M	32 months	Partial closure	Normal	1½ hours	None	Normal
11	46	F	4 years	Not closed	None	5 minutes	In loop near terminal ileum	Hypertonic
12	28	M	14 months	Closed	None	30 minutes	None	Normal
13	30	F	2 months	Partial closure		2 hours	None	Not noted
14	35	M	2 months	Not closed		2 hours	None	Normal
15	36	M	29 months	Not closed	None	4 hours	None	Normal
16	35	M	2 years	Not closed	None	1 hour	None	Hypotonic
17	55	F	3 years	Partial closure	Normal	4 hours	None	Normal
18	39	M	16 months	Closed	Normal	2 hours	None	Hypotonic
19	55	F	26 months	Closed	None	2½ hours	None	Normal
20	30	F	Not known	Not known	Increased	2½ hours	In jejunum	Hypertonic
21	25	F	10 months	Closed	Normal	2 hours	In jejunum behind stomach	Hypertonic
22	40	F	Not known	Closed	None	Residue 24 hours	None	Normal
23	60	M	18 months	Closed	None	2½ hours	None	Normal
24	45	M	6 years	Closed	Normal	2 hours	None	Normal
25	35	M	5 months	Closed	Increased	2½ hours	None	Hypertonic

A ROENTGENOGRAPHIC STUDY OF OSTEITIS DEFORMANS—PAGET'S DISEASE

BY C. WINFIELD PERKINS, M.D. *

Captain, M. C., U. S. A.

NEW YORK CITY

PAGET'S disease of the bones, so named after Sir James Paget[1], whose papers were read and published in 1876, is not as rare a malady as one would suppose, considering the meager literature on the subject and the lack of general knowledge of the disease as evinced by the profession at large. Abbe[2] of New York, in a recent article refers to the name given in the German textbooks as "*osteomyelitis fibrosa*." This he states is a "clinical delusion" so far as the name is concerned, as a fibrous change in the bones is nowhere to be found, but a bony hypertrophy or overgrowth is especially illuminated on the roentgenogram. Regarding its distinctive pathological processes as mirrored on the roentgen plate, the name is, therefore, misleading and illusionary.

The etiology is in a stage of conjecture, there being several theories but nothing of a positive nature. Goldthwait[3] suggests as a cause, some interference with metabolism affecting the shafts of bones, that is, some loss in balance between waste and repair, perhaps brought about by hypersecretion or hyposecretion of some glandular tissues of the body, thereby interfering with the normal bone-forming or bone-destroying mechanism. Cushing in his monograph states, that "in every case of increased intracranial tension from whatever source, there probably occur secondary changes in the hypophysis, often with gross deformities and resultant functional disturbances, which frequently elicit recognizable clinical manifestations." This

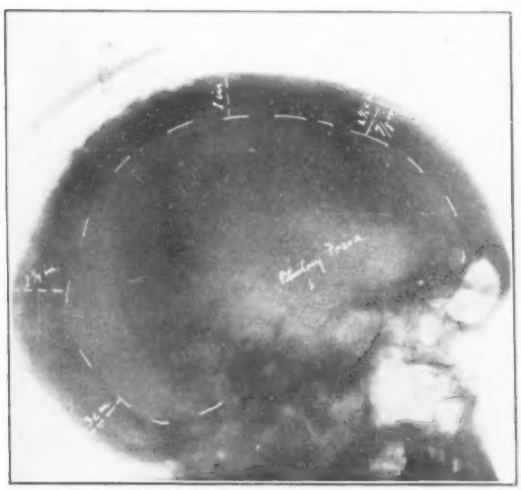


FIG. 1. LEONINE TYPE OF SKULL WITH THICKENED INNER AND OUTER PLATES. The moth-eaten appearance is due to porosity of the outer plate. The sella turcica is small, measuring 10 x 10 mm. (normal 12 x 15 mm.). There is a shadow which suggests a calcareous roof over the pituitary fossa. The frontal and maxillary sinuses simulate acromegaly in that they are large, having a blown out appearance. The posterior portion of the spheroid is unusually dense.

FIG. 2. CHEST WITH THICKENED CLAVICLE AND RIBS. INCREASED DENSITY OF THE HILA SHADOWS WITH CALCAREOUS CHANGES.

* Authority to publish granted by Board of Publication, Surgeon General's Office, Washington, D. C.

patient (Fig. 1) complained of headache which is an early signal of intracranial pressure. In view of the above statements, the fact remains that the roentgenogram demonstrates a small, undersized pituitary fossa, which is bridged over with a sclerosed roof. This, in turn, is associated with a dense posterior sphenoid sinus. There is food for thought in such observations. We immediately think of the possibility and significance of hypopituitarism in its relationship to the etiology of this disease. This patient, as in nearly all cases of osteitis deformans, has the clinical appearance of hypophysis involvement as shown in the small stature, large head, prominent frontal and maxillary sinuses (blown out type), bowed extremities, and the general physical make-up of pituitarism. Up to the present time, the writer has been unable to find any roentgenological literature referring to the subject, though the matter has been hinted at by several well-known clinicians without the roentgen data.

The patient has a small pituitary fossa as compared with the size of the skull and normal averages from recent studies made by the writer[4] and others, on the normal pituitary fossa. In this case (Fig. 1) it measures 10 x 10 m, whereas the normal average is about 12 x 15 m, accounting for the normal variances.

The French school of clinicians represented by André Chastel[5] is inclined to view the etiology on a basis of syphilitic hereditary hypothesis. The reports of Lannelogue before the Academy of Medicine, Paris, 1903, give various discussions. In one instance, of 61 cases of Paget's disease one was due to basic syphilitic heredity. It is perfectly logical to assume that any pituitary involvement could be secondary, as a result of a primary disease, especially as this patient has had a syphilitic history and recently a mild, positive Wassermann. Therefore the pituitary or glandular theory as suggested by Goldthwait[3] seems strongly indicated in the study of this patient.

It may be fairly stated that it is not a

FIG. 3. THE BONES OF THE LEFT ARM ARE SLIGHTLY DENSER THAN NORMAL.

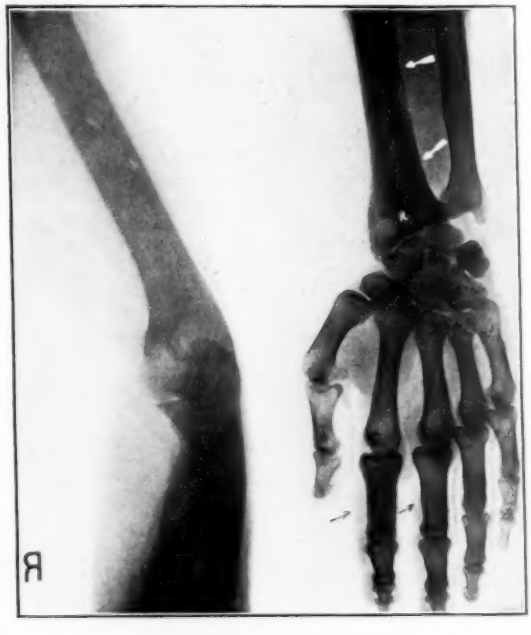


FIG. 4. RIGHT ARM WITH THICKENED DENSE LOWER END OF RADIUS.

disease confined to any one of the bones, for the various bones are likewise affected in the generaly hypertrophy of the osseous tissue. Morton Prince[6], in an able article, speaks of the pathology of this disease as divided into three separate divisions, namely, (a) absorption of bone; (b) new formation of bone without calcification, and (c) new formation of bone with calcification. Any one pathologic process may predominate. The growth is slow and any portion of the body may be affected, from the head downward. The head and the bones of the extremities, especially the tibia, are points of election for definite pathologicalp rocesses, though the other bones of the economy are involved as shown in the accompanying roentgenograms (Fig. 2) namely, the clavicle, ribs, radius, phalanges, lumbar spine, femur and hip bones. The distinct prominence of the frontal and maxillary sinuses are strongly suggestive of pituitarism, being acromegalic in appearance.

The bony hypertrophy assumes an ivory-like consistency in some cases, and in making a roentgen exposure requires much longer time to penetrate the structure for the impression on the plate than the same portion of the anatomy in normal subjects.

Hayhurst and Hartung[7] in their report of two cases in 1911, by the roentgen method of examination describe not only the above characteristics, but in addition, a general arteriosclerosis in the upper and lower extremities, as shown on the roentgenogram. They also report normal sella turcica or pituitary fossa. In this patient no sclerosed changes have been noted in the arteries, but a small pituitary fossa roofed in with sclerosed changes, is significant.

FIG. 5. THE BONES OF THE LEFT HIP-JOINT ARE DENSE. Note especially the femur.

FIG. 6. THE LEFT TIBIA IS THICKENED AND PRESENTS A MOTH-EATEN APPEARANCE IN THE UPPER HALF. THE BONE IS DECIDEDLY BOWED. THE PERIOSTEUM IS THICKENED. THE FIBULA IS NORMAL. THE RIGHT TIBIA AND FIBULA APPEAR NORMAL WITH THEEXCEPTION OF A SLIGHT INCREASE IN DENSITY.

It may be interesting to note that the first roentgen examination of Paget's in France, was made by Gallois in 1901, at the Béclère Institute in Paris. As a method for pathological study of bone "in vivo," the roentgen-ray is unsurpassed for accurate observations of the osseous changes throughout the body.

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AUSTIN LATTING HOBBS

Dr. Austin Latting Hobbs was born at Peterton, Kansas, January 18, 1882. He was graduated from Princeton in 1907, and from the College of Physicians and Surgeons, Columbia University, in 1911. At the time of sailing for France he had an office at 11 East 48th Street, New York City, and was Roentgenologist to Roosevelt, Park and Volunteer Hospitals.

Dr. Hobbs was commissioned a First Lieutenant in the A. E. F., and sailed for France with the Presbyterian Hospital Unit in May, 1917. He was stationed at Base Hospital No. 1, A. E. F., at Etretat, France. He died at St. Mesnil, France, on September 26, 1918.

Mrs. Christine Terhune Herrick, whose son was Doctor Hobbs' most intimate friend in college, says: "From the first I

was impressed by his stability of character, and this impression grew as I knew him better. He was a boy absolutely to be relied upon, of entire integrity, steadfast, a firm friend and one of whom those who knew him could always be sure. As he grew into manhood these qualities continued and

were his most striking characteristics. He was genial and ready for enjoyment but there was always the background of strength, courage and trustworthiness that was felt by all who knew him.

Colonel George E. Brewer mentions the splendid work of Dr. Hobbs at Etretat and speaks of his great popularity not only in the hospital but in the village as well. He was very much interested in the orphans and children, and it was largely through his efforts and those of Mrs. Hobbs that a Christmas celebration for the whole village was held.

Dr. Hobbs was detailed to study the work at A. E. F. Evacuation Hospital No. 1, and Mobile Hospital No. 3 in the front area. It was during this work that he contracted influenza which developed rapidly into pneumonia which caused his death at the age of thirty-six. BYRON C. DARLING.

PAUL MORGAN STROTHER

Dr. Paul Morgan Strother of Lynchburg, Va., a member of the American Roentgen Ray Society since 1915, was injured in an automobile accident on November 25, 1918, and died as a result of the accident the following day.

He was born of a prominent Virginia family on April 29, 1884, in Lynchburg, Va., and received his early education at the public schools of that city. For one year he attended the Virginia Polytechnic Institute, then entered the Medical Department of the University of Virginia, from which he received the degree of M.D. in June, 1906.

Following his graduation, he established himself in the town of Scottsville, Va., and pursued the general practice of medicine for about six years. Then he determined to take up roentgenology as a specialty and came to Richmond, where he was associated with the writer in the capacity of student and assistant for more than a year. In 1914 he settled in Lynchburg, his native city, limiting his work to roentgenology.

From the beginning his ability was recognized, and he rapidly attained a position at the head of the medical profession of that city. At the time of his death he was President of the Lynchburg Academy of Medicine, which comprises the City of Lynchburg and the County of Campbell. In addition to membership in his local society, he was a member of the Medical Society of Virginia, the American Medical Association, and the American Roentgen Ray Society. Rarely has one of so brief an experience attained such a degree of excellence in this branch. His work has been recognized as of the best type, and his opinions were thoroughly reliable.

Dr. Strother had been active in Red Cross work and had planned to volunteer for service in the Medical Corps of the Army. He was arranging to do so when the armistice was signed.

In the death of Dr. Strother the profession of Lynchburg and of the State of Virginia has sustained a loss difficult to refill. He leaves a wife, who was Miss Elisabeth Bradley of Crosswicks, N. J., and one child, a daughter of two years. He is also survived by his mother, a sister, and two brothers. ALFRED L. GRAY.

NOTICE OF MEETING

The Twentieth Annual Meeting of the American Roentgen Ray Society will be held at Saratoga Springs, N. Y., on September 3, 4, 5 and 6, 1919. Reserve this date and make plans to attend. Details will be published in later issues.

TRANSLATIONS & ABSTRACTS

NOVITZKY, JOSEF. Devitalized (dead) Teeth. (*J. Nat. Dent. Assn.*, Vol. 5, June, 1918, p. 555.)

Injury to other parts of the body is commonly due to devitalized teeth and the treatment and retention of dead teeth in the jaws. Devitalized teeth in which putrefactive changes have taken place should be removed from the jaws not by ordinary pulling or extraction but by surgical dissection. Areas of disintegrated bone or new growth tissue at the root ends of dead teeth cannot be adequately treated through the root canals of the teeth. The old method of extracting will not remove all of the diseased area; blind curetting after extraction may be helpful or it may be harmful. In extraction, such complications as antral perforations, necrotic antral walls, or polypi will probably not be discovered.

It is questioned whether it is possible to retain dead teeth in which putrefactive changes have not taken place. Putrefactive changes may be retarded in a tooth, but appear after a few years. It is concluded from cases observed that every devitalized tooth will in course of time become putrescent. Therefore no tooth should be devitalized.

When devitalization cannot be prevented, immediately after devitalization a dead tooth may be extracted without danger to the patient. Then, a devitalized tooth should be immediately extracted; but if the devitalized tooth has been allowed to remain in the jaw, surgical dissection is necessary to remove infection.

BLACK, ARTHUR D. Abstract of Discussion of Symposium on Mouth Infections. (*J. Am. M. Assn.*, Vol. LXIII, Dec. 5, 1914, p. 2029.)

The two groups of chronic foci, the chronic alveolar abscess and the so-called pyorrhea pocket, involve the peridental membrane; there is a suppurative destruction of the tissue of the cementum covering the root of the tooth; and the cementoblasts, the only cells which could cause reattachment of that tissue, are destroyed. All the specialized elements necessary to the connection of root with bone are lost, and reattachment of the tissue to the cementum of the root is impossible. The roentgenogram shows this very clearly. Careful examination will show a line down the side of and close against the root, which is practically always in advance of destruction of the tissue elsewhere. Microscopic examination of sections confirms this view. Pockets remain about such teeth and the underlying tissue is subject to frequent reinfection. The dental treatment indicated is the elimination of the focus in alveolar abscess by resecting the denuded root end, or the extraction of the tooth. If it is a pocket alongside the root, exposed to the fluids of the mouth, the tooth must be extracted or palliative treatment employed which will be effective against reinfection.

POTTER, HOLLIS E. The Roentgen Ray in the Diagnosis of Pyorrhea. (*J. Am. M. Assn.*, Vol. LXVIII, Feb. 10, 1917, p. 417.)

The exact technic necessary in periapical disease is not needed in pyorrhea. In pyorrhea the *x*-ray can bring to light some of the minor changes about the roots of individual teeth; for this, only the most critical roentgenography with careful and intelligent reading is of value. Whether the erosion lies on the labial, buccal, or lingual aspect cannot be judged from a roentgenogram, even if a double line is present. The most accurate portrayal is obtained by the stereoscopic method. The roentgenogram should be made at a considerably lower angle than for demonstration of the apexes. The general line showing the ulcerative process will usually show clearly in the region of the septal bone.

Limitations in the value of the *x*-ray findings occur sometimes, *e.g.* when a loose pyorrhea tooth does not show the expected well-defined findings, because the atrophy is probably diffuse; or a pocket may be shown around a firm tooth. In an ulcerative process in which bone shadows show partial decalcification, the process is in an active stage; in well demarcated cases, the process may be considered more chronic in type.

MOOREHEAD, FREDERIC B. The Prevalence of Chronic Mouth Infections and their Management. (*J. Am. M. Assn.*, Vol. LXVII, Sept. 16, 1916, p. 845.)

Of 718 cases cited illustrating incidents of chronic mouth infections in three groups of cases 498 were chronic arthritis; 70 were chronic infections but not suffering from joint lesions; 150 were referred for examination because of some systemic disease. Alveolar abscess occurred in 89%, 74%, and 69% of these groups respectively.

Chronic alveolar abscesses may be classified as primary and secondary: primary, those in which infection occurs through the root canal from an infected pulp; from faulty technic in root canal treatment; and from failure to properly seal the root canal and pulp chamber in introducing permanent filling materials. The secondary infections are blood borne, the predisposing cause being a lowered resistance in the periapical tissue brought about first by the careless use of arsenic as a devitalizing agent and secondly, by the indiscriminate use of irritating agents in the treatment of root canals.

In pyorrhea and root abscesses, conservative measures may be adopted, the extent of involvement of the peridental membrane being the decisive factor in choosing between conservative and radical treatment. The focus of infection must be removed, whether the patient is well or ill. Not more than 25% of the root canals treated may be considered safe, and not over 10% of dentists are competent to undertake difficult root canal operations. It is the lesser of two evils to remove the tooth.

The roentgen ray is the decisive method in diagnosing and in determining the extent of tissues lost. A large granuloma may involve only the spongiosum, and where the external bony plates are thick and dense, the roentgen ray will not define the area. When conservative measures are decided on, the roentgen ray should be used to check up the process of repair.

WADE, THOMAS B. Interpretation of Roentgenograms. (*Dental Cosmos*, Vol. LX, Aug., 1918, p. 695.)

The clinical diagnosis should always precede and should be confirmed or rejected by the roentgen ray diagnosis. The roentgenographic analysis is quantitative rather than qualitative, is accurate for boundaries but indefinite for specific names. The roentgen ray diagnosis of root canal work, fractures, and foreign bodies is final. It does not reveal whether pus or granulation tissue is present. Diagnosis depends on the comparison of the possible pathological tissue with normal tissue.

Diseases of the dental pulp show two varieties of pathological changes: (1) A suppurative inflammation ending in an acute alveolar abscess, characterized by pericementitis, does not show on the film because there is no destruction of the bone. (2) A proliferative pericementitis or the granuloma, which is symptomless, can usually be diagnosed by the roentgen ray. The film of a granuloma shows a clearly circumscribed area. Roentgen ray of a cyst shows a large dark area with a definite border, but from a roentgenogram one cannot differentiate between a large abscess area and a cyst. The operation, however, is the same. The roentgen ray reading of a chronic alveolar abscess in most cases shows a shading off from the dark area into the light or surrounding tissues. Blind abscesses show about the same reading as chronic abscesses, except that there is no protecting membrane between the pus and the blood stream. From a roentgenogram we cannot differentiate between a blind abscess and a chronic abscess, and in some cases between a chronic abscess and a granuloma.

A necrotic area shows a honeycomb appearance. When the root apex is absorbing, surgical means must be employed. It is impossible to differentiate between syphilitic, arsenical, phosphoric, or tubercular necrosis; diagnosis depends on the history, clinical diagnosis, and blood test.

NOVITZKY, T. JOSEF. Notes on Radiographs and the Surgical Treatment of Septic Teeth and Alveolar Process. (*Dental Items Interest*, Vol. XI, Jan., 1918, p. 35.)

In spite of the diagnostic help which the roentgen ray has been in dentistry, many men refuse to accept it or they minimize its value. Value of the roentgenograph is not seen because ability to interpret it depends on experience and mature judgment. Roentgenography should be used in conjunction with clinical findings. Errors in roentgenography are generally due to the mental equation of the diagnostician. All

extractions of dead teeth should be preceded by roentgenographic study to establish pathological conditions. Technic of dissection followed by curettement should be used. The roentgenograph indicates areas of disintegrated bone which often result in secondary systemic lesions. Necrosed alveolar processes showing no local symptoms but resulting in systemic symptoms are indicated by the *x*-ray. In many pyorrhea cases, the roentgenograph will show bone sepsis. Cases show that arthritis, tonsillitis, and Bell's palsy are relieved by dental operations following roentgen-ray diagnosis of septic oral areas.

GRIEVES, CLARENCE J. The Clinical Status of the Gingivo-Peridental and Dento-Alveolar Infective Focal Portals. (*J. Nat. Dent. Assn.*, Vol. 5, Aug., 1918, p. 775.)

Accurate intra-oral roentgenographs, with not more than two teeth in focus at any time, and occasionally extra oral plates, are necessary to arrive at a correct diagnosis of damage to adjacent dental tissues or calcific pulpal changes, etc. Even in the dental profession there is no agreement on the interpretation of these roentgenographs.

The professional roentgenographer's findings as to teeth cannot be trusted. The appearance of the dental foramina approaching the inferior bicuspids apices is interpreted as infective erosion or rarefaction; the eruptive tooth crypts of superior laterals, which often persist with open trabeculæ, as well as those in which the second and third molar apices appear to lie, are often reported as rarefactions. In this way, normal teeth have been lost. The roentgenograph amounts to little without the judgment of a dental specialist.

There are several fixed diagnostic features, dependable in interpretation: the character and stability of the hard lining of each alveolar socket, and the atratum durum or lamina dura, showing as a dense line. Its disappearance, together with the supporting trabeculæ in the gingival third, marks the deepening gingivitis; (in the middle third, the extent of alveolar resorption to great stress). Its disappearance in areas, particularly in the middle and apical third, with thickening of the dark line representing the peridental membrane, indicates an undue stress or a proliferating periodontitis. Variation of the lamina about any, and particularly, about a pulpless tooth, condemns it to exploration for normality. The roentgenogram indicates a condensing osteitis; the crypt wall containing granulomata appearing as dense as the lamina. Absence of rarefaction is not always evidence of the normal. Good roentgenograms are rarely misleading and postoperative results are more pronounced than the roentgen-ray would indicate.

In gingival, the so-called pyorrhea infections, if the traumatic factor can be corrected, even in malocclusion, 90% of the cases can always be cured, if preceding lacunar or perforating canal absorption has not undermined the tooth, provided that the dental operator will develop the fine technique of the periodontic specialist. But there can be no greater menace to a patient's health than retention of infected teeth.

In infection, there are three vital histologic factors: 1. The vitality and resistance which is offered to septic invasion by the granular layer of Tomes; 2, the recent demonstration by Noyes of a definite lymph supply in the dental pulp (the sterilization of dentin and cementum without destruction of adjacent tissues has not been accomplished as yet); all the methods, including the latest ionic medication, are much too drastic and objectionable, destroying the reparative cells but not the pathogenic element; and 3, the apical cementum and adjoining peridental membrane which has reparative power if not burned up by germicidal processes or if not too deeply infected.

Just as soon as it can be clinically and roentgenographically demonstrated that diseased periapical regions exist, medication should be stopped and surgery resorted to. All such lesions must be eradicated promptly without waiting for the patient to develop any diseases ascribed to septic teeth.

The dentist should not act as internist, nor should a physician, omitting to look for every possible focus, diagnose the focus offhand as oral. A complete diagnosis should be made, obtaining the opinions of all the specialists concerned. The mouth is sometimes overlooked in diagnosis.

If the patient will report in time, it is possible to remove the pulp and aseptically fill vital root apices of a large proportion of such teeth; but an infected or abscessed root should not be retained, unless apiectomy is attempted.

RHEIN, M. L. The Importance of a Correct Differential Diagnosis of the Predisposing Causes in Cases of Interstitial Gingivitis or Pyorrhea Alveolaris. (*J. Am. M. Assn.*, Vol. LXVIII, Feb. 10, 1917, p. 417.)

Pyorrhea alveolaris is a result of malnutrition plus infection, and also most frequently plus irritation; it is intensified if arteriosclerosis of the ultimate capillaries sets in. All forms of pyorrhea must commence with some form of gingivitis, yet the tissues in this and all succeeding stages vary in clinical appearance. Classification is necessary, as "diabetic pyorrhea," "tubercular pyorrhea," or "nephritic pyorrhea". The symptomatology and treatment should be entirely different in each type. Prognosis of pyorrhea or gingivitis must depend largely on the possibility of obtaining a cure of the malnutritional factor. The dentist treating these and all other mouth diseases should be as well educated in general medicine as the specialist in any other department of medicine.

BILLINGS, FRANK. The Principles Involved in Focal Infection as Related to Systemic Disease. (*J. Am. M. Assn.*, Vol. LXVII, Sept. 16, 1916, p. 847.)

In infection there are three chief factors: (1) The pathogenic microörganisms and the conditions which modify their virulence and pathogenicity. (2) The host and the conditions which modify his susceptibility to infection. (3) The nature and result of the reactions.

The tissues involved in the focal infections, especially those due to the streptococcus-pneumococcus group, act as a culture medium in which variations of the microörganism are brought about by variations in the blood supply, or other factors which may alter the character of the confined infectious agents.

The local infection may be coincident with general systemic infection or general infection may occur at some indefinite time subsequent to the local tissue invasion. Systemic invasion may be by way of the blood or lymph stream.

The tissues of the host are disturbed by the reactions (abscess, necrosis, hemorrhage, and gangrene) and by virulent microörganisms. Virulent streptococci and gonococci will cause purulent destructive arthritis. Less virulent streptococci and gonococci will usually result in a chronic serous or fibrinous arthritis. Pathogenic bacteria of relatively low virulence excite reactions leading to chronic confined general infection.

BLACK, ARTHUR D. Roentgenographic and Microscopic Studies of Tissues Involved in Chronic Mouth Infections. (*J. Am. M. Assn.*, Vol. LXIX, Aug. 25, 1917, p. 599.)

3300 roentgenograms were made of 400 persons, not necessarily patients, mostly selected from several sources without regard to previous inquiry as to mouth or health conditions. The results indicated the frequency of infections of the maxillary bones. The study is to be continued. The study showed that 56% of the persons under 25 years of age, 72% of those between 25 and 30, 87% of those between 30 and 40, 89% of those between 40 and 50, and 100% of those over 50 had infections involving the maxillary bones. Considering the incidence of abscesses in relation to root fillings: in 178 good root fillings in large canals, 13 were abscessed—or 8%; of 338 large canals poorly filled, 225 were abscessed—or 67%; of 242 small badly filled canals, 154 were abscessed—or 65%. This shows the need of careful technic in treatment of root canals.

The suppurative detachment of the peridental membrane is in practically all cases permanent. If such teeth are permitted to remain in the mouth, they menace the health of the individual. Their value in mastication should be weighed against the danger of nephritis, endocarditis, and other secondary results, all of which are insidious in onset, and likely to be serious before symptoms are noticed.

BYRON C. DARLING.

MILLER, WILLIAM SNOW. Stereoroentgenograms of the Injected Lung as an Aid to the Study of the Lung Architecture. (*Am. Rev. of Tuberculosis*, Journal of the National Tuberculosis Association, 1919, Vol. II, No. 11, p. 659.)

In a previous communication (*Anat. Rec.* 1918, XV, 47), the author describes the preparation of an injection mass for studying the blood vessels of the lungs. Following the injection of the mass, stereoroentgenograms were made.

The basis of the injection mass consists of

a suspension of corn-starch in 70 per cent alcohol, to which vermilion granules are added when it is desired to obtain a uniform dense shadow, and ultramarine blue granules when a less dense and finely granular shadow is desired. By the use of a greater or less quantity of 70 per cent alcohol, the injection masses may be made to penetrate to any desired distance within the lung. If the bronchi alone are to be injected a thick vermilion mass gives the best results; for if the mass be too thin it will penetrate the air sacs and a blurred shadow will result, or else the whole lung will appear solid.

The present paper deals with the study of the relation of the pulmonary artery, the pulmonary vein and the bronchi to each other in specimens of pig and dog lungs, following the injection with the above described mass, and viewed with stereoroentgenograms which accompany the article.

The purpose of the article is to emphasize the importance of knowing the normal lung architectural appearance from the standpoint of the bronchi, the pulmonary artery and vein, their relation to each other, and their distributions.

By means of these injections and stereoroentgenogram study, the author points out that the pulmonary artery follows in all its subdivisions the course and subdivisions of the bronchial tree, and that each main branch of the pulmonary artery arches over its corresponding stem bronchus and comes to occupy a position posterior and slightly lateral to the bronchus; while the pulmonary vein relations to the bronchi are quite different and are anterior and mesial to the stem bronchi, and in their ultimate distributions are as far removed from the bronchi "as possible."

Three beautiful stereoroentgenograms of these well prepared specimens are used successfully to illustrate the text. Lungs of two pigs and one dog were used.

Stereoroentgenograms of the lungs of a pig in which the pulmonary artery is injected with vermilion starch mass and then distended with air. The pulmonary artery is beautifully outlined in its entirety with the injection mass. Closely approximated to this shadow on its mesial surface are the main stem bronchi filled with air, which can be easily seen, while on the mesial side of the bronchi can be seen a faintly denser shadow of the pulmonary vein.

Stereoroentgenogram of the lungs of a pig in which the pulmonary vein of the left lobus inferior is partially injected with a thick ultramarine blue starch mass and then distended with air. The shadow of the pulmonary vein can be clearly seen situated anterior and mesial to the main stem bronchus.

Stereoroentgenogram of the lungs of a dog in which the pulmonary artery is injected with vermilion starch mass and the pulmonary vein with an ultramarine blue starch mass. The artery and vein are both shown while the bronchi are obscured by the overlying shadows of the injected artery and vein.

The author concluded that even though the pulmonary arteries are uninjected, they can be recognized in stereoroentgenograms as comparatively dense linear markings along the lateral wall of the bronchi, and under similar conditions the main venous trunk can be made out on the mesial side of the stem bronchus, but in its ultimate distribution its branches are not associated with the bronchi.

Further, that the study suggests once more the importance of a knowledge of lung structure in interpreting densities on the roentgen ray plate.

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